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Fig. 1

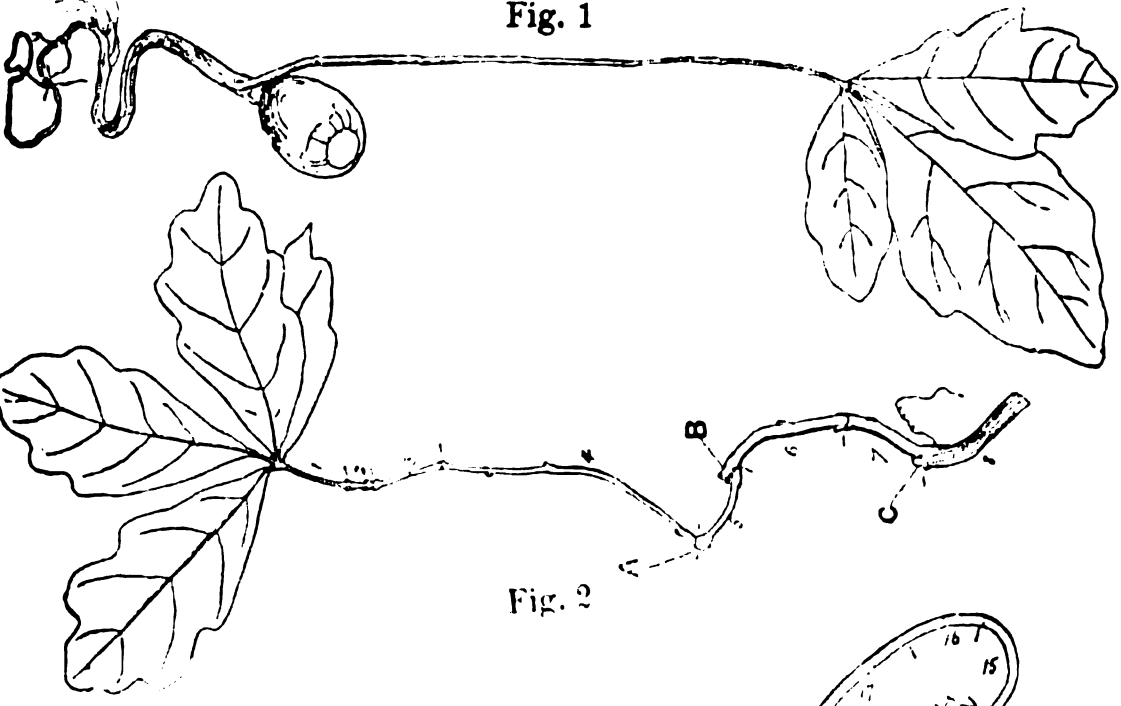
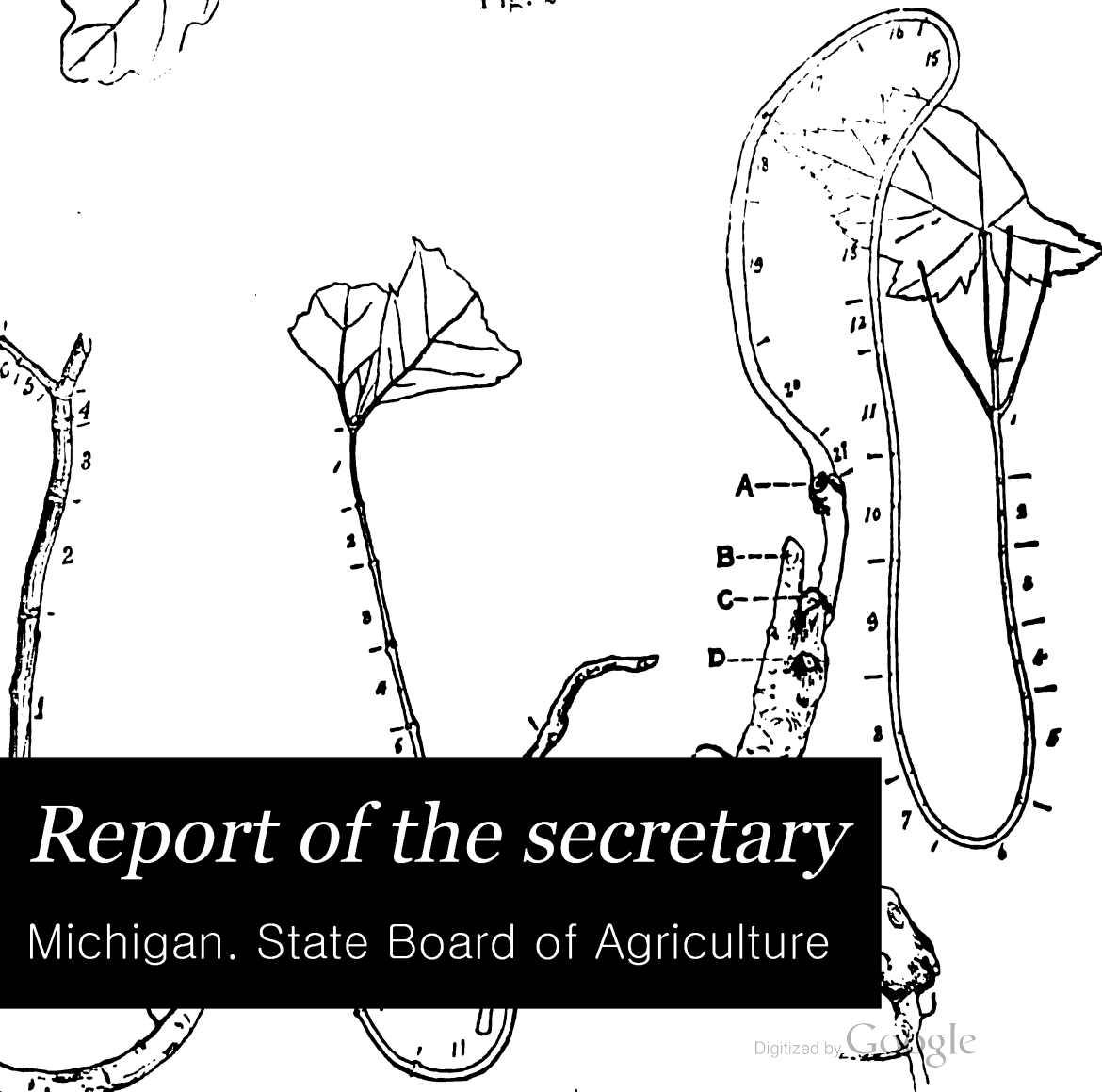


Fig. 2



Report of the secretary

Michigan. State Board of Agriculture

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FROM

Board of agriculture, Michigan

7 June, 1901.

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Anal. p. 137

TWENTY-SEVENTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

STATE BOARD OF AGRICULTURE

OF THE

STATE OF MICHIGAN

FROM

JULY 1, 1887, TO JUNE 30, 1888.

BY AUTHORITY.

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Board of Aquiculture

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REPORT OF THE SECRETARY

OF THE

STATE BOARD OF AGRICULTURE.

AGRICULTURAL COLLEGE,
July 1, 1888.

TO HON. CYRUS G. LUCE,

Governor of the State of Michigan:

SIR,—I have the honor to submit to you herewith, as required by statute, the accompanying report for the fiscal year ending June 30, 1888, with supplementary papers.

Very respectfully,

HENRY G. REYNOLDS,

Secretary of the State Board of Agriculture.

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STATE BOARD OF AGRICULTURE.

	Term expires.
Hon. FRANKLIN WELLS, Constantine, - - - - -	1891
President of the Board.	
Hon. HENRY CHAMBERLAIN, Three Oaks, - - -	1889
Hon. ELIJAH W. RISING, Davison Station, - -	1889
Hon. GEO. B. HORTON, Fruit Ridge, - - - - -	1891
Hon. WM. B. McCREERY, Flint, - - - - - -	1893
Hon. CHAS. W. GARFIELD, Grand Rapids, - - -	1893
Hon. CYRUS G. LUCE, Governor of the State, } Hon. EDWIN WILLITS, M. A., President of the College, }	*Ex-Officio.*

HENRY G. REYNOLDS, M. S., Agricultural College, Secretary.
BENJAMIN F. DAVIS, Lansing, Treasurer.

STANDING COMMITTEES.

The President of the Board is ex-officio a member of each of the Standing Committees.

Finance: - - - - - - - - -	Wm. B. McCreery, E. W. Rising.
Farm Management: - - - -	Geo. B. Horton, E. W. Rising.
Botany and Horticulture: -	C. W. Garfield, Henry Chamberlain.
Buildings: - - - - - - - - -	E. W. Rising, Geo. B. Horton.
Employes: - - - - - - - - -	Henry Chamberlain, Wm. B. McCreery.
Farmers' Institutes: - - - -	E. W. Rising, Geo. B. Horton.
Mechanics: - - - - - - - -	Henry Chamberlain, C. W. Garfield.
Veterinary Dep't.: - - - -	Geo. B. Horton, Wm. B. McCreery.
College Land Grant: - - -	Wm. B. McCreery, Henry Chamberlain.
Military Dep't.: - - - - -	Wm. B. McCreery, C. W. Garfield.
State Weather Service: - -	Henry Chamberlain, Edwin Willits, C. W. Garfield.

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STATE AGRICULTURAL COLLEGE.

[UNDER CONTROL OF THE STATE BOARD OF AGRICULTURE.]

FACULTY AND OTHER OFFICERS.

EDWIN WILLITS, M.A., President and Professor of Political Science, Constitutional Law and Business Law.
THEOPHILUS C. ABBOT, LL. D., Professor of Mental Philosophy and Logic.
ROBERT C. KEDZIE, M.A., M.D., Professor of Chemistry and Curator of the Chemical Laboratory.
ALBERT J. COOK, M S., Professor of Zoölogy and Entomology and Curator of the General Museum.
WM. J. BEAL, M.A., M.S., Ph. D., Professor of Botany and Forestry and Curator of the Botanical Museum.
ROLLA C. CARPENTER, M.S., C.E., M.M.E., Professor of Mathematics and Civil Engineering.
SAMUEL JOHNSON, M.S., Professor of Practical Agriculture and Superintendent of the farm.
ELIAS J. MACEWAN, M.A., Professor of English Language and Literature.
E. A. A. GRANGE, V.S., Professor of Veterinary Science.
*LIBERTY H. BAILEY, Jr., M.S., Professor of Horticulture and Landscape Gardening, and Superintendent of the Horticultural Department.
HENRY G. REYNOLDS, M.S., Secretary.
W. F. DURAND, Ph. D., Professor of Mechanics and French, and Director of the Shops.
WENDELL L. SIMPSON, Second Lieutenant 24th U. S. Infantry, Professor of Military Science and Tactics.
FRANK S. KEDZIE, M.S., Assistant Professor of Chemistry.
LOUIS G. CARPENTER, M.S., Assistant Professor of Mathematics.
HENRY R. PATTENGILL, B.S., Assistant Professor of English.
HENRY W. BAIRD, B.S., Ass't Secretary and Instructor in Book Keeping.
JOSEPH B. COTTON, B.S., Instructor in Mathematics.
WILLIAM S. HOLDSWORTH, B.S., Instructor in Drawing.
MRS. MARY J. CARPENTER, M.S., Librarian.
ERNEST G. LODEMAN, Instructor in French.
LOUIS KNAPPER, Florist.
CHARLES S. CRANDALL, B.S., Foreman of the Horticultural Department.
JAMES WISEMAN, Foreman of the Iron Shops and Engineer in Chief.
HIRAM T. FRENCH, B.S., Assistant in Farm Experiments.
H. CAMPBELL, Carpenter and Foreman of the Wood Shops.
HENRY MUNN, Foreman of the Farm.
EDWARD R. LAKE, B S., Assistant in Botany.
PHILIP B. WOODWORTH, B.S., Assistant in Chemistry.
EUGENE DAVENPORT, B.S., Assistant in Experiments.
C. B. WALDRON, B.S., " " "
RICHARD HISCOCK, Engineer.
WM. D. BROWN, Herdsman.

* Resigned to accept the chair of Horticulture at Cornell University.

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AGRICULTURAL EXPERIMENT STATION

OF THE

STATE AGRICULTURAL COLLEGE.

[UNDER CONTROL OF THE STATE BOARD OF AGRICULTURE.]

OFFICERS OF THE STATION.

EDWIN WILLITS, M.A., Director.
HENRY G. REYNOLDS, M.S., Secretary and Treasurer.
SAMUEL JOHNSON, M.S., Agriculturist.
*LIBERTY H. BAILEY, M.S., Horticulturist.
ROBERT C. KEDZIE, M.A., M.D., Chemist.
ALBERT J. COOK, M.S., Entomologist.
WILLIAM J. BEAL, M.A., M.S., Ph. D., Botanist.
E. A. A. GRANGE, V.S., Veterinarian.

---

*Resigned.

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STATE WEATHER SERVICE.

[UNDER CONTROL OF THE STATE BOARD OF AGRICULTURE.]

STANDING COMMITTEE IN CHARGE.

HON. HENRY CHAMBERLAIN, - - - - - Three Oaks.
HON. EDWIN WILLITS, - - - - - - - Agricultural College.
HON. CHAS. W. GARFIELD, - - - - - - Grand Rapids.
DIRECTOR, - - - - N. B. Conger, Serg't. U. S. Signal Service, Lansing.
ASSISTANT, - - - E. H. Nimmo, Lansing.

STATE INDEPENDENT FORESTRY COMMISSION.

This Commission is composed of the members of the State Board of Agriculture and has the following officers:

PRESIDENT, - - - - Hon. Franklin Wells, Constantine.
AUDITOR, - - - - - Hon. Wm. B. McCreery, Flint.
SECRETARY, - - - - Henry G. Reynolds, Agricultural College.
BOARD OF DIRECTORS, Hon. Chas. W. Garfield, Grand Rapids.
Prof. Wm. J. Beal, Agricultural College.

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ACCOUNTS OF THE STATE AGRICULTURAL COLLEGE.

FOR THE FISCAL YEAR ENDING JUNE 30, 1888.

SECRETARY'S ACCOUNT.

				Dr.	
July 1,	1887.	To cash on hand		$1,484 32	
"	"	To cash on deposit with College treasurer, less $38.96 June interest and $1,382.54 outstanding warrants		8,080 55	
"	"	By balance due students on deposit accounts			$1,726 0
June 30	1888.	To special appropriation receipts as per table No. 2:			
		From State Treasurer	$35,185 00		
		From Institution	16,347 91		
				51,532 91	
June 30,	1888.	By special appropriation disbursements			55,782 13
"	"	To current account receipts as per Table No. 3:			
		From State Treasurer	$32,006 10		
		From Institution	16.554 38		
				48,560 48	
June 30,	1888.	By current account disbursements			46,613 66
"	"	To balance due students on deposit accounts		1,456 67	
"	"	By cash on hand			3,857 11
"	"	By cash on deposit with College Treasurer less $48.78 June interest, and $1,086.32 outstanding warrants			3,086 01
				$111,064 93	$111,064 93

The above statement may, perhaps, be more easily understood from the following:

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TABLE NO. 1.—*Tabular Exhibit of Secretary's Account.*

Name of Account.	Balance Sheet, July 1, 1887.		Transactions July 1, 1887, to June 30, 1888.		Balance Sheet, June 30, 1888.	
	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.
Cash	$1,484 32		*$2,372 79		$3,857 11	
College treasurer	† 8,080 55			* $4,944 54	† 3,086 01	
Students' deposits		$1,726 02	* 269 35			$1,456 67
Special appropriations		9,195 92	55,782 13	51,532 91		4,946 70
Current account	1,407 07		46,613 66	46,560 48		539 75
Totals	$10,921 94	$10,921 94	$105,087 93	$105,087 93	$6,943 12	$6,943 12

* Balance of Dr. and Cr. transactions.

† Treasurer's statement is greater July 1, 1887, by $38.98, interest for June, 1887, not entered above, and by $1,382.34 June warrants still outstanding at close of month; and June 30, 1888, by $48.78 interest for June, 1888, not entered above, and by $4,066.33 warrants outstanding at close of month.

SUMMARY OF TREASURER'S REPORT.

B. F. Davis in Account with Agricultural College.

	Dr.	Cr.
To balance July 1, 1887	$9,452 07	
To receipts from State Treasurer and Secretary of State Board of Agriculture from July 1, 1887, to June 30, 1888	83,271 10	
To interest on deposits 13 months @ 4 per cent	690 09	
By warrants paid from July 1, 1887, to June 30, 1888		$91,192 15
By balance on hand June 30, 1888		7,221 11
	$98,413 26	$98,413 26

The above is a correct summary of my report to the State Board of Agriculture.

B. F. DAVIS, Treasurer.

2

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TABLE NO. 2.—*Statement of Special Appropriation Account for Fiscal Year, July 1, 1887, to June 30, 1888.*

Name of Appropriation.	Balance of Account, July 1, 1887.		Receipts During year.		Total Available.	Total Expended.	Balance of Account, June 30, 1888.		Total Appropriation for 1887-1888.	Balance of Appropriation in State Treasury, June 30, 1888.
	Dr.	Cr.	From State Treasurer.	From Institution.			Dr.	Cr.		
Weather service, instruments									$2,067 50	
" " signals		$29 78			$29 78	$29 78			200 00	
" " telephone and telegraph		841 96	$1,000 00		1,841 96	1,778 63		$63 33	4,000 00	* $1,468 27
" " incidental expenses		195 05	350 00	$4 50	549 55	271 57		277 98	700 00	
" " salary of assistant		88 90	800 00		888 90	800 02		88 88	1,600 00	400 00
Farm department, drainage & perm't imp'ts		400 00	400 00		800 00	667 59		132 41	800 00	
" " bridge and approaches		500 00	500 00		1,000 00	1,000 00			1,000 00	
" " hand implements		100 00			100 00	58 00		42 00	200 00	100 00
" " two-horse cultivator			35 00		35 00	35 00			35 00	
" " two sets harness			50 00		50 00	16 00		34 00	50 00	
" " two plows			30 00		30 00	30 00			30 00	
" " lumber		100 00			100 00	43 76		56 24	200 00	100 00
" " furnishing farm house	$3 75		100 00		96 25	48 76		47 49	200 00	100 00
" " engine and boiler			500 00		500 00	500 00			500 00	
" " class room apparatus	3 34		150 00		146 66	100 80		45 86	300 00	150 00
" " experimental work		425 00			425 00	425 00			500 00	
" " appropriation of 1885		136 67			136 67	136 67				
Horticultural department		440 60	400 00		840 60	840 60			1,000 00	
" " culvert			250 00		250 00	171 91		78 09	250 00	
" " barn			500 00		500 00	408 70		91 30	500 00	
" " laboratory			2,500 00		2,500 00	1,556 86		943 14	5,000 00	2,500 00
Green house		112 25	170 00		282 25	236 00		44 25	340 00	

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" " painting and repairs	60 04		400 00		339 96	339 96			400 00	
" " addition to dwelling			400 00		400 00	400 00			400 00	
Mechanical department		523 04	3,000 00		3,523 04	2,996 24		526 80	4,000 00	
" " addition to shops			3,000 00		3,000 00	3,000 00			3,000 00	
Repairs of buildings		873 48	500 00		873 48	873 48			1,000 00	
Contingent building fund				5,048 99	5,048 99			5,048 99		
Steam works		647 50	2,500 00	3 62	3,151 12	2,842 60		308 52	4,500 00	1,000 00
Water works			2,000 00		2,000 00	2,000 00			2,000 00	
Artesian well		212 58			212 58	212 58			1,000 00	
Mathematical and engineering department		321 46	300 00		621 46	574 74		46 72	600 00	
Botanical department		206 09	400 00		606 09	606 09			800 00	
Veterinary department		100 00	100 00		200 00	138 62		61 38	200 00	
Chemical department		931 61	1,000 00		1,931 61	1,232 96		698 65	2,000 00	
Zoological department		567 67	750 00		1,317 67	1,234 96		82 71	1,500 00	
English department			100 00		100 00	16 50		83 50	100 00	
Military department		230 80			230 80	159 08		71 22	500 00	250 00
Library		778 74	1,000 00	40 80	1,819 54	1,790 30		29 24	3,000 00	1,000 00
Farmers' Institutes		38 13	300 00		338 13	338 13			600 00	
Fire escapes			500 00		500 00	187 31		312 69	500 00	
Professor's barn			200 00		200 00	200 00			200 00	
Dormitory			3,500 00		3,500 00	5,144 88	1,644 88		10,000 00	6,500 00
Apartment building			3,500 00		3,500 00	3,315 85		184 15	10,000 00	6,500 00
Student labor (see Table No. 5)		962 24	4,000 00		4,962 24	4,020 20		942 04	8,000 00	2,000 00
Experiment station				§ 11,250 00	11,250 00	15,000 00	3,750 00			
Balances	9,195 92						4,946 70			
Totals	$9,263 05	$9,263 05	$35,185 00	$16,347 91	$60,728 88	$55,782 18	$10,341 58	$10,341 58	$73,792 50	$22,068 27

* $531.73 of the appropriation for 1887 being unexpended Dec. 31st was covered into the treasury. § From U. S. Treasurer.

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TABLE NO. 3.—*Current Account, July 1, 1887, to June 30, 1888.*

On Account of,	Dr. To Disbursements.	Cr. By Receipts.
State Treasurer, interest on proceeds of sales of U. S. land grant, see Table No. 11	.....	$32,006 10
Students' fees, of which $886.00 is transferred to special contingent building fund, see Table No. 4	.....	6,374 39
Salaries, see Table No. 6	$29,900 27	83 34
Farm Department, see Table No. 7	4,537 94	6,822 09
Horticultural Department, see Table No. 8	1,896 57	1,078 60
Green-house Department	377 18	263 60
Mechanical Department	976 32	123 95
Heating, lighting, cleaning and repairs	4,077 40	188 90
Academic Departments	1,885 29	56 52
Offices, postage, stationery, advertising and sundry	1,413 70	.....
Fertilizer license fees	.....	400 00
State swamp land grant sale, transferred to special contingent building fund	.....	444 20
Interest and exchange, transferred to special contingent building fund	.....	718 79
Totals	$44,564 67	$48,560 48
Transferred to special contingent building fund	2,048 99	.....
Balance at beginning of period, July 1, 1887	1,407 07	.....
Balance at close of period, June 30, 1888	539 75	.....
Footings	$48,560 48	$48,560 48

TABLE NO. 4.—*Students' Fees.*

	Current Account.	Special Account, Contingent Building Fund.
Room rent	$2,940 67	.....
Incidental expense fee	1,882 50	.....
Damages	9 30	.....
Physiological dissection fee	33 50	.....
Veterinary dissection fee	16 50	.....
Chemical analysis fee	605 92	.....
Special examination fee	.....	$86 00
Matriculation fee	.....	630 00
Diploma fee	.....	170 00
Totals	$5,488 39	$886 00

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TABLE NO. 5.—*Student Labor.—Account of Wages paid for 12 Months, July 1, 1887, to June 30, 1888.*

	Amount.
Farm Department	$631 35
Horticultural Department	1,188 64
Green-house Department	301 48
Mechanical Department and repairs	201 96
Signal flags	43 40
Night watch, bell ringing, choir, etc.	313 28
Janitor	658 45
Offices	111 30
Veterinary Department	25 64
Zoological Department	98 80
Botanical Department	101 56
Chemical Department	125 64
Military Department	99 40
Library	119 30
Total	$4,020 20

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TABLE NO. 6.—*Salaries.*

	Paid from			Total.
	Current account.	Experiment Station account.	Other Sources.	
President, dwelling and	$3,200 00			$3,200 00
One Professor, dwelling and	1,400 00	$600 00		2,000 00
One Professor on half pay	1,000 00			1,000 00
Four Professors, dwelling and $1,800 each	4,800 00	2,400 00		7,200 00
Three Professors, dwelling and $1,800 each	5,400 00			5,400 00
*One Professor, dwelling and			$1,328 00	1,328 00
One Professor	1,500 00			1,500 00
One Assistant Professor	1,800 00			1,800 00
One Assistant Professor, rooms and	1,200 00			1,200 00
One Assistant Professor	1,200 00			1,200 00
Two Instructors, rooms and $600 each	1,200 00			1,200 00
One Instructor	300 00			300 00
§ Secretary, dwelling and		500 00	1,000 00	1,500 00
Assistant Secretary, rooms and	600 00			600 00
Librarian, rooms and	600 00	150 00		750 00
Foreman of Farm, dwelling, board and	600 00			600 00
Foreman of Garden, rooms and	1,000 00			1,000 00
Foreman of Iron Shop, dwelling and	900 00			900 00
Foreman of Wood Shop, rooms and	600 00			600 00
Florist, dwelling and	750 00			750 00
One Assistant in Experiments, room and		600 00		600 00
Two Assistants in Experiments, $500 each		1,000 00		1,000 00
Three Assistants in Experiments, $300 each		900 00		900 00
†Engineer			500 00	500 00
Herdsman, dwelling and	450 00			450 00
Fireman			360 00	360 00
Total	$28,000 00	$6,150 00	$3,688 00	$37,838 00

*Army officer detailed as Professor of Military Science and Tactics. Salary paid by U. S. Government.
§ $1,000 of salary as Secretary of the Board of Agriculture is paid from the State Treasury.
† Paid from special appropriation for steam works.

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TABLE NO. 7.—*Account with Farm Department.*

On Account of,	Dr. To Disbursements.	Cr. By Receipts.
Labor and team, aside from student labor	$1,484 37	$5 77
Farm house	775 87	632 21
Cattle	1,774 00	5,461 92
Sheep	48 79	22 75
Swine	5 00	203 90
Grain	100 23	312 09
Produce	15 52	115 95
Implements and repairs	178 89	.....
Wood	56 47	67 50
Fertilizer	5 50	.....
Office, etc	98 80	.....
Balance	2,284 15	.....
Footings	$6,822 09	$6,822 09

TABLE NO. 8.—*Account with Horticultural Department.*

On Account of,	Dr. To Disbursements.	Cr. By Receipts.
Labor, aside from student labor	$935 51	.....
Team	180 17	.....
Grounds	200 78	.....
Vegetable garden	76 02	.....
Fruit garden	15 79	.....
Orchard	63 68	.....
Implements and repairs	174 24	.....
Ice	73 39	.....
Office, etc	176 99	.....
Sundry receipts	.....	$1,078 60
Balance	.....	817 97
Footings	$1,896 57	$1,896 57

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TABLE NO. 9.—*Agricultural College Lands, United States Grant, Record of Sales and Forfeitures to the Present time.*

Year.	Number of Acres sold at Original Sale.			Forfeited Lands Resold.			Total Sales.			Number of Acres Reverting by Forfeiture.	Aggregate of Sales, less Forfeitures to end of each Year. Acres.	Balance Remaining Vacant at end of each Year. Acres.
	Acres.	Average Price Per Acre.	Amount.	Acres.	Average Price Per Acre.	Amount.	Acres.	Average Price Per Acre.	Amount.			
1867												235,682.46
1868	520.	$5 00	$2,600 00				520.	$5 00	$2,600 00		520.	235,162.46
1869	13,480.	3 19	43,000 00				13,480.	3 19	43,000 00		14,000.	221,682.46
1870	3,280.	3 44	11,280 00				3,280.	3 44	11,280 00		17,280.	218,402.46
1871	9,372.44	3 37	31,637 32				9,372.44	3 37	31,637 32		26,652.44	209,030.02
1872	20,580.25	3 19	65,660 75				20,580.25	3 19	65,660 75		47,232.69	188,449.77
1873	17,205.89	3 15	54,177 67	40.	$3 62	$145 00	17,245.89	3 15	54,322 67	40.	64,438.58	171,243.88
1874	2,039.95	3 20	6,519 75	40.	3 00	120 00	2,079.95	3 19	6,639 75	638.72	65,879.81	169,803.65
1875	4,798.99	3 08	14,796 97	40.	3 00	120 00	4,838.99	3 08	14,916 97	560.	70,158.80	165,523.66
1876	1,953 73	3 12	6,101 19	520.	4 38	2,280 00	2,473.73	3 39	8,381 19	1,758.40	70,874.13	164,808.33
1877	1,634.75	3 00	4,904 25	200.	3 00	600 00	1,834.75	3 00	5,504 25	1,438.06	71,270.82	164,411.64
1878	4,034.80	3 10	12,504 40	1,135.73	3 91	4,443 65	5,170.53	3 28	16,948 05	2,415.73	74,025.62	161,656.84
1879	6,782.12	3 02	20,506 96	1,318.06	3 08	4,064 18	8,100.18	3 03	24,560 54	1,978.11	80,147.69	155,534.77
1880	8,826.56	3 03	26,729 58	280.	3 18	890 00	9,106.56	3 03	27,619 58	4,926.33	84,327.92	151,354.54
1881	6,168.97	3 96	24,447 25	360.	4 33	1,560 00	6,528.97	3 96	26,007 25	1,997.19	88,869.70	146,812 76
1882	10,225.99	5 00	51,129 95	1,637.01	5 09	8,335 05	11,863.	5 01	59,464 90	760.11	99,972.59	135,709.87
1883	7,035.57	5 00	35,177 85	1,680.	5 08	8,448 00	8,715 57	5 00	43,625 85	560.	108,128.16	127,554.30
1884	1,846.01	5 09	9,390 05	526.45	5 38	2,832 25	2,372.46	5 15	12,222 30	200.	110,300.62	125,381.84
1885	704.88	5 74	4,044 40	119.52	5 67	677 60	824.40	5 73	4,722 00	525.47	110,599.55	125,082.91
1886	720.00	5 83	4,200 00	560.	5 78	3,240 00	1,280.00	5 81	7,440 00	440.	111,439.55	124,242.91
1887	1,718 27	6 45	11,091 35	320.	5 00	1,600 00	2,038.27	6 23	12,691 35	200.	113,277.82	122,404.64
1888	2,031.18	6 02	12,235 90	160.	5 00	800 00	2,191.18	5 95	13,035 90	640.	114,829.00	120,853.46
Total	124,960.35	$3 62	$452,134 89	8,936.77	$4 49	$40,145 73	133,897.12	$3 68	$492,280 62	19,068.12		

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TABLE NO. 10.—*Agricultural College Trust Fund.*

Year.	Receipts of State Land Office on account of Principal for Agricultural College Lands sold.	Refunded on account of erroneous payments.	Balance transferred to credit of Agricultural College Trust Fund.	Aggregate to credit of Agricultural College Trust Fund at close of each fiscal year.
1868	$2,300 00		$2,300 00	
1869	11,865 00		11,865 00	$14,165 00
1870	5,895 00		5,895 00	20,060 00
1871	20,101 53		20,101 53	40,161 53
1872	33,621 93	$174 54	33,447 39	73,608 92
1873	29,583 47		29,583 47	103,192 39
1874	4,686 75		4,686 75	107,879 14
1875	5,399 24		5,399 24	113,278 38
1876	5,939 30	390 00	5,549 30	118,827 68
1877	2,337 22		2,337 22	121,164 90
1878	9,619 99		9,619 99	130,784 89
1879	8,590 53		8,590 53	139,375 42
1880	13,762 28		13,762 28	153,137 70
1881	20,341 18	60 00	20,281 18	173,418 88
1882	51,449 27		51,449 27	224,868 15
1883	34,482 28	825 90	33,656 38	258,524 53
1884	13,802 87		13,802 87	272,327 40
1885	12,460 87		12,460 87	284,788 27
1886	16,545 31		16,545 31	301,333 58
1887	26,731 62		26,731 62	328,065 20
1888	18,122 35		18,122 35	346,187 55

NOTE.—Fifteen thousand dollars of the above fund was invested from 1870 to 1871 in War Bounty Bonds and held by the College.

TABLE NO. 11.—*Agricultural College Interest Fund.*

Year.	Interest on Agricultural College Fund, at 7 per cent. paid by State Treasurer from Specific Tax Fund.	Interest from purchasers on balances due on certificates for part-paid land, less refundings and expenses for Appraisals, etc.†	Receipts for penalty.	Trespass Collections.	Total accrued to credit of Agricultural College each year.	Amount paid over to Treasurer of Agricultural College.	Balance remaining to credit of Agricultural College Interest Fund at close of each fiscal year.
1869		$56 68	$2 28		$58 96		$58 96
1870	*$874 95	1,789 56	56 42		2,720 93	$2,779 89	
1871	§ 1,897 97	2,317 24	70 63		3,785 84	2,976 00	809 84
1872	3,953 17	3,099 51	122 97		7,175 65	6,774 47	1,211 02
1873	6,040 33	4,907 77	110 96		11,059 06	12,238 48	31 60
1874	7,407 65	6,499 21	155 12		14,061 98	11,896 60	2,197 58
1875	7,717 24	6,552 93	125 97	$50 00	14,446 14	14,656 00	1,987 72
1876	8,124 31	6,692 47	306 64	1,706 75	16,830 17	18,817 89	
1877	8,396 64	5,726 58	189 64	860 00	15,172 86	15,172 86	
1878	8,740 62	6,405 26	247 21	414 00	15,807 09	13,320 61	2,486 48
1879	9,409 73	6,664 80	276 55	627 14	16,978 22	16,602 02	2,862 68
1880	10,240 28	7,333 23	148 73	115 00	17,837 24	17,799 15	2,900 77
1881	11,426 93	8,642 08	285 47	580 77	20,935 25	20,451 85	3,384 17
1882	13,957 04	8,345 45	204 96		22,507 45	25,891 62	
1883	16,741 38	9,141 80	206 96	4,659 96	30,749 60	26,139 13	4,610 47
1884	18,739 02	8,881 96	237 56	51 16	27,909 72	27,402 94	5,117 25
1885	19,645 33	9,121 14	329 06	674 87	29,770 40	29,599 97	5,287 68
1886	20,571 65	9,323 98	565 41		30,461 04	29,920 68	5,828 04
‡1887	16,493 96	7,577 57	309 84	229 96	24,611 37	19,761 06	10,678 35
1888	23,425 64	7,310 84	394 85	1,275 27	32,406 60	32,006 10	11,078 85

*This amount was interest on war bounty bonds in which the fund was invested at the time.
§ $525 of this was interest on war bounty bonds in which the fund was invested part of the year.
† Refundings amounted to $352.27, ranging from nothing in 1880 and since to $145.21 in 1874. Appraisal expenses amounted to $1,127.70, ranging from nothing in 1872 to $208.94 in 1886. Advertising amounted to $631.56, ranging from nothing in 1870 to $218.35 in 1884. Trespass examination amounted to $4.00 in 1883.
‡ Nine months.

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TABLE NO. 12.—*Showing by Counties the amount of Agricultural College Land sold at original sale during the fiscal year ending June 30, 1888.*

Counties.	Acres.	Price per Acre.	Purchase Price.	Amount Paid.	Amount Due.
Alcona	584.93	$5 00	$2,924 65	$2,774 65	$150 00
Alcona	240.00	6 00	1,440 00	900 00	540 00
Alcona	120.00	7 00	840 00	630 00	210 00
Alcona	40.00	8 00	320 00	80 00	240 00
Alcona	40.00	10 00	400 00	100 00	300 00
Iosco	127.99	5 00	639 95	639 95	.....
Kalkaska	40.00	10 00	400 00	400 00	.....
Oscoda	238.26	5 00	1,191 30	1,191 30	.....
Oscoda	40.00	8 00	320 00	320 00	.....
Presque Isle	40.00	7 00	280 00	140 00	140 00
Wexford	80.00	5 00	400 00	100 00	300 00
Wexford	280.00	6 00	1,680 00	1,200 00	480 00
Wexford	40.00	7 00	280 00	280 00	.....
Wexford	40.00	8 00	320 00	320 00	.....
Wexford	80.00	10 00	800 00	800 00	.....
Totals	2,081.18	$6 02	$12,235 90	$9,875 90	$2,360 00

TABLE NO. 13.—*Showing by counties the amount of Forfeited Agricultural College Land sold during the fiscal year ending June 30, 1888.*

Counties.	Acres.	Price per Acre.	Purchase Price	Amount Paid.	Amount Due.
Alpena	40.00	$5 00	$200 00	$200 60	.....
Cheboygan	40.00	5 00	200 00	50 00	$150 00
Montmorency	40.00	5 00	200 00	50 00	150 00
Oscoda	40.00	5 00	200 00	200 00	.....
Totals	160.00	$5 00	$800 00	$500 00	$300 00

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TABLE NO. 14.—*Showing, by Counties, the Amount of Agricultural College Land Forfeited to the State During the Fiscal Year Ending June 30, 1888.*

County.	No. of acres.
Benzie	40
Charlevoix	80
Cheboygan	80
Grand Traverse	80
Kalkaska	40
Montmorency	240
Otsego	40
Wexford	40
Total	640

TABLE NO. 15.—*Showing, by Counties, the Amount of Agricultural College Land Vacant June 30, 1888.*

Counties.	Acres.
Alcona	20,688.14
Alpena	920.00
Antrim	3,120.93
Benzie	4,480.00
Charlevoix	3,685.09
Cheboygan	5,091.10
Grand Traverse	440.00
Iosco	26,666.98
Kalkaska	1,000.68
Manistee	5,960.00
Missaukee	799.64
Montmorency	7,644.30
Oscoda	13,771.86
Otsego	3,744.74
Presque Isle	320.00
Wexford	22,520.00
Total	120,853.46

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SUMMARY OF INVENTORY, JUNE 30, 1888.

College farm and park, 676 acres @ $70		$47,320 00
Buildings—College hall	$15,000 00	
Williams hall	45,000 00	
Wells hall	25,000 00	
Abbot hall, unfinished	5,144 88	
Library and museum building	25,000 00	
Chemical laboratory	18,000 00	
Botanical laboratory	6,000 00	
Mechanical laboratory	10,800 00	
Veterinary laboratory	5,400 00	
Horticultural laboratory, unfinished	1,556 86	
Armory and assembly hall	6,000 00	
Farm house	3,500 00	
Four brick houses @ $3,000	12,000 00	
Two brick houses @ $3,500	7,000 00	
President's and two frame houses	20,728 00	
One frame house	4,000 00	
Apartment building, unfinished	3,315 85	
Herdsman's house	600 00	
Ten barns at Professors' houses @ $250	2,500 00	
Horticultural barn and shed	1,500 00	
Cattle barn and shed	3,800 00	
Sheep barn	2,500 00	
Horse barn	3,000 00	
Piggery	2,000 00	
Brick work-shop	600 00	
Corn-house	500 00	
Green-house, dwelling and stable	10,150 00	
Feed barn	1,200 00	
Grain barn	1,600 00	
Tool-house	1,300 00	
Observatory	150 00	
Boiler-house and chimney	5,000 00	
New bee-house	600 00	
Old bee-house	280 00	
		250,725 59
Iron bridge over Cedar river		1,000 00
Water-works		6,539 95
Artesian well and connections		1,000 00
Steam works—		
Four boilers 4 ft. x 12 ft. each @ $600	$2,400 00	
Two boilers 5 ft. x 12 ft. each @ $925	1,850 00	
Underground piping	2,700 00	
Two small steam pumps $110 and $200	310 00	
Pipes and fittings	360 84	
Tools for steam fitting	464 41	
		8,085 25
Ten dozen tackle fire escapes		144 00
Ten fire extinguishers		400 00
Fuel on hand, 300 tons bituminous coal @ $3.50		1,050 00
Farm Department—Cattle	$13,175 00	
Horses	1,150 00	
Sheep	720 00	
Swine	315 00	
Implements, produce, etc.,	9,112 83	
		24,472 83
Horticultural Department—		
Team, harness, etc.	$739 00	
Tools	944 50	
Vegetable garden	223 75	
Miscellaneous	135 10	
		2,042 35
Footing carried forward		$342,779 97

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INVENTORY.—*Continued.*

Brought forward		$342,779 97
Green-house—		
Plants and implements	$6,370 70	
Furnaces	300 00	
		6,670 00
Mechanical Department—		
Wood shop	$1,932 98	
Iron shop	4,593 07	
Blacksmith shop	304 85	
Physical apparatus	1,383 32	
		8,214 22
Chemical Department—Furniture and fixtures	$440 50	
Physical apparatus	6,524 50	
Chemical apparatus and chemicals	4,927 75	
		11,892 75
Mathematical and Engineering Department—		
Surveying instruments, etc.	$1,510 68	
Telescope, magic lantern and views	1,104 00	
Testing machine	475 00	
		3,089 68
Botanical Department—Museum	$3,774 00	
Microscopes and class-room apparatus	1,877 98	
Office furniture and fixtures	50 30	
Herbarium	810 00	
		6,512 28
Library—Books and pamphlets	$19,500 00	
Furniture	1,441 00	
		20,941 00
Veterinary Laboratory—Museum, furniture and apparatus		2,056 10
Zoological Department—Furniture and apparatus		946 60
General museum—Collections and cases		11,672 50
College Hall—Furniture		1,011 75
Williams Hall—Furniture and club equipments		421 98
President's office		220 00
Secretary's office		454 35
Armory—Furniture, military equipments and gymnastic apparatus		516 50
Flag-staff and flags		175 00
Apiary—Bees, stock, etc., not belonging to Experiment Station		425 00
Experiment Station, not including items separately mentioned above		6,174 74
		$424,174 42

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EXPERIMENT STATION INVENTORY.

Included in the above total of $424,175,12 is $10,128.46 which belongs to the Experiment Station, consisting of the following items :

Lands donated to the Station—		
80 acres at Grayling, fenced and improved	$1,910 00	
10 " " Harrison, " " "	270 00	
10 " " Oscoda, " " "	120 00	
		$2,300 00
Buildings—		
Experimental feed barn	$1,200 00	
Horticultural laboratory, experimental rooms	1,200 00	
Apiary	600 00	
		3,000 00
Library and offices—Books	$759 82	
4 book-cases, 4 doz. filing boxes, carpet, stationery, etc.	325 40	
		1,085 22
Farm Department—Implements	$73 63	
17 steers for feeding experiment	1,090 00	
Feed and office equipment	168 92	
		1,332 55
Horticultural Department—Implements	$82 50	
Microscope, camera, balances, etc.	265 35	
		347 85
Chemical Department—Sundry apparatus	$156 59	
Chemical and physical balances	529 20	
Horse tools on Grayling farm	146 50	
		832 29
Botanical Department—Microscope and sundry apparatus		186 21
Veterinary Department—Wagon, tools, etc.	$269 90	
3 unsound horses for experimentation	165 00	
		434 90
Zoological Department—		
Microscope, balances and insect cases	$354 65	
Apiary, 18 colonies of bees, tools, etc.	254 79	
		609 44
		$10,128 46

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TABLE No. 16.—*Income of the Agricultural College from all sources, from the date of its foundation to the present time.*

Year.	From State Legislature.			Interest from United States Land Grant.	Total.
	Appropriations for Current Expenses.	Appropriations for Special Purposes.	Land Sales, Salt Spring and Swamp Land Grants.		
1855			$56,320 00		$56,320 00
1856					
1857	$40,000 00				40,000 00
1858					
1859	37,500 00				37,500 00
1860					
1861	6,500 00		152 25		6,652 25
1862	10,000 00		218 97		10,218 97
1863	9,000 00		407 80		9,407 80
1864	9,000 00		726 09		9,726 09
1865	15,000 00		1,156 61		16,156 61
1866	15,000 00		1,094 27		16,094 27
1867	20,000 00		7,608 38		27,608 38
1868	20,000 00		592 49		20,592 49
1869	20,000 00	$30,000 00	17,559 00	$58 96	67,617 96
1870	20,000 00		1,320 02	2,720 93	24,040 95
1871	18,250 00	10,500 00	4,135 72	3,785 84	36,671 56
1872	18,250 00	3,000 00	217 05	7,175 65	28,642 70
1873	21,796 00	15,602 00	10 13	11,059 06	48,467 19
1874	13,000 00	15,602 00	150 13	14,061 98	42,814 11
1875	7,638 00	7,755 50	144 53	14,446 14	29,984 17
1876	7,638 00	6,755 50	1,773 09	16,830 17	32,996 76
1877	6,150 00	30,686 80	979 06	15,172 86	52,988 72
1878	6,150 00	5,686 80	826 60	15,807 09	28,470 49
1879	4,971 80	16,068 32	712 22	16,978 22	38,730 56
1880	4,971 80	7,068 32	797 55	17,837 24	30,674 91
1881	7,249 00	43,720 50	461 95	20,935 25	72,366 70
1882	7,249 00	8,945 50	358 46	22,507 45	39,060 41
1883	8,385 00	23,793 00	391 95	30,749 60	63,319 55
1884	8,385 00	10,526 00	1,259 90	27,909 72	48,080 62
1885		35,103 00	187 50	29,770 40	65,060 90
1886		22,617 00		29,920 68	52,537 68
1887		* 44,040 00	† 198 20	† 19,761 06	63,999 26
1888		30,752 50	444 20	§ 47,006 10	78,202 80
Total	$362,083 60	$368,222 74	$100,204 12	$364,494 40	$1,195,004 86

* Including appropriations of $5,487.50 for weather service and $1,000.00 for forestry commission.
† Oct. 1, 1886, to June 30, 1887, nine months.
§ Includes $15,000.00 received directly from U. S. Treasury on account of experiment station.

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A SUMMARY OF THE RESOURCES OF THE MICHIGAN AGRICULTURAL COLLEGE.

Farm, buildings and equipments, as per inventory on pp. 20-21	$424,175 12
Agricultural College trust fund, from sale of lands of United States grant	346,187 55
Balance due on purchase money " " " " "	102,162 17
120,853.46 acres @ $5 per acre yet unsold " " " "	604,267 30
800 acres @ $5 per acre yet unsold of swamp land grant	4,000 00
Total	$1,480,792 14

The 120,853.46 acres yet vacant of the U. S. land grant are given in detail as located in the different counties in table No. 15, page 19.

The 800 acres of swamp land is what still remains unsold of a grant from the State to the College of swamp lands located in the townships of Lansing and Meridian in Ingham county, and Bath and De Witt in Clinton county.

The present amount of the trust fund is taken from the last line (that for 1888) of the fifth column of table No. 10, page 17.

The balance due on purchase money is reported by the Commissioner of the State Land Office, and consists of the total amount for which the College lands have been sold up to the present time, *i. e.*:

The total of the tenth column in table No. 9, page 16	$492,280 62
Less the payments made on these sales, constituting the trust fund	346,187 55
	$146,093 07
And less balances unpaid on abandoned descriptions which have reverted to the State by forfeiture for non-payment of interest, as shown in column eleven of Table No. 9, page 16	43,930 90
	$102,162 17

There is a discrepancy between these figures and the statement published last year, as will be seen by the following comparison:

	1	2	3	4	5
	June 30, 1887.	Transactions June 30, 1887, to June 30, 1888.	June 30, 1888, if Columns 1 and 2 are Correct.	June 30, 1888, as Reported from Land Office.	Discrepancy between Columns 3 and 4.
Sales	$479,214 72*	$13,085 90*	$492,280 62	$492,280 62*	
Payments	328,065 20*	18,122 35*	346,187 55	346,187 55*	
Unpaid	$151,179 52		$146,093 07	$146,093 07	
Lapsed	30,895 48	1,969 48*	32,764 96	43,930 90	
Balance Due	$120,284 04*		$113,328 11	$102,162 17*	$11,165 94

*The figures marked with the asterisks are the ones reported from the Land Office, the others being mere deductions from them.

If the balance reported due June 30, 1888, is right, then that reported for June 30, 1887, is wrong, and not only that, but also the reports for 1886 and 1885, as they agree substantially with the amount given for 1887.

The commissioner is kindly looking into the matter for me, but up to the time of publication the solution has not been reached.

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DEPARTMENT REPORTS.

REPORT OF PRESIDENT WILLITS.

To the Honorable State Board of Agriculture:

I herewith submit my fourth annual report, with the reports of the several departments of this college.

Since my last report there have been conferred degrees upon the persons named as follows: Bachelor of Science: Ai A. Abbott, Guy Arnold, Irving B. Bates, Edgar A. Burnett, Harklass L. Chapin, George C. Crandall, William W. Diehl, James C, Duffey, Carrie M. French, Winthrop C. Hall, Coie L. Himebaugh, George J. Hume, Harry W. McArdle, Robert W. McCulloch, Edwin W. Redman, William C. Sanson, Frank R. Smith, Chas. E. St. John, Clare B. Waldron, Obadiah C. Wheeler, Chas. S. Whitmore, Henry H. Winde. James Cassidy, Prof. of Botany and Horticulture, Fort Collins, Col. Master of Science: Judge M. D. Chatterton, Mason, Mich.; Prof. Theries D. Hinebauch, Kalamazoo, Mich.; Hon. Bela Hubbard, Detroit, Mich.; Lieut. J. A. Lockwood, Agricultural College, Mich.; Prof. Allen C. Redding, Findlay, Ohio; Dr. Hal. C. Wyman, Detroit, Mich.

The degree of Bachelor of Science was also conferred upon the following named persons of the class of 1886: W. H. Clemons, J. W. Clemons, E. G. Eldridge, W. G. Everhart, G. S. French, Jno. Hooker, H. B. Howe, C. H. Judson, W. A. Kinnan, A. L. Nichols, W. R. Rummler, G. L. Spangler, E. A. Whitney.

THE GENERAL CONDITION OF THE COLLEGE

is good, and has been for the whole year. The students have been diligent and orderly, with only a few cases of discipline, and the friction incident to the complicated character of the work of an institution like this has been very slight. The manual labor feature has been well sustained, and the students have been cheerful and prompt in its performance. The faculty have been earnest, and given to the college the full measure of their energies; there has been no divided purpose, no outside distraction to draw off their thoughts and time.

THE EXPERIMENT STATION.

In my last report I stated that the act establishing Experiment Stations had been passed by Congress, but that by an accident in hasty legislation the appropriation necessary to carry it into operation had failed, and that further legislation would be required. I spent two weeks in Washington last

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January, with other members of the executive committee appointed at a meeting of the colleges and stations at Washington last October to urge upon Congress the prompt appropriation of the moneys required, and we had the pleasure of securing the final passage of such an act, and the signing of the same by the President January 1, 1888. On the 26th of that month this college organized as one of the Departments, under the Hatch law, so called, an

AGRICULTURAL EXPERIMENT STATION,

with the following

OFFICERS OF THE STATION.

Edwin Willits, M. A., Director; R. C. Kedzie, M. A., M. D., Chemist; A. J. Cook, M. S, Zoologist; W. J. Beal, M. A., M. S., Ph. D., Botanist; Samuel Johnson, M. S., Agriculturist; E. A. A. Grange, V. S., Veterinarian; L. H. Bailey, M. S., Horticulturist; Henry G. Reynolds, M. S., Secretary and Treasurer.

The funds for said station being in part immediately available, and the whole $15,000 being payable on or before July 1, 1888, said new department proceeded at once to its work under said act. This work was comparatively easy of adoption, as in almost all lines this college has had a more or less well defined system of experiments, which were transferred to the new department, with a concerted plan for a better and more extensive development. As in another place I have submitted, as Director, a full report of the work of said station to this date, accompanied by detailed reports of its general officer, I beg leave to refer to it for further information in regard to the same.

It may not be out of place here to put on record

THE DUTIES OF THE STATE BOARD OF AGRICULTURE AND OF THE COLLEGE.

Under the acts of Congress in 1862 and in 1887, and the several acts of the Legislature, we have in charge:

1. The equipment and administration of the Agricultural College as an educational institution, including military tactics and drill.
2. The testing of all fertilizers used in the State.
3. The issuing of monthly bulletins of the work in the several departments of the college in agriculture and subjects allied thereto.
4. As a forestry commission for the State.
5. The State weather signal service, in co-operation with the United States weather signal service.
6. The agricultural experiment station.
7. The holding of farmers' institutes.

It will be seen that the scope of these duties is wide, and that the careful supervision of all these matters, calls for much of the time and thought of the Board, and of the faculty. A full report of the labor in the promotion of each of the several duties above designated, will be found under the proper heads of the annual report.

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THE NEW BUILDINGS

for which appropriations were made by the last Legislature, are approaching completion. At my last report the extension of the shops, including the blacksmith shop, had been finished, and with the forty new sets of tools for which means were afforded, one of the purposes for which the extension was asked has been accomplished, to wit: the giving the students in the agricultural course instruction in wood and iron work. Under the programme established, the freshman class have such instruction in the carpenter shop during the spring term and the sophomore class in the blacksmith's shop during the fall term of each year, in the main so arranged as to be compulsory at the seasons of the year when work is slack on the farm, the garden and grounds. The results have been highly satisfactory.

There was a long delay in getting to work on the other buildings, for the reason that the plans as submitted to the Legislature, and for which appropriations were asked, exceeded in cost the sums appropriated. Bids for the same were twice rejected, and it was not till January last that contracts were made for the same. Messrs. Cleveland and Ward are the contractors, and they promise to have the new dormitory, which the Board has named Abbott Hall, in honor of Dr. Abbott, so long president of the college, completed in time for the opening of the fall term. The apartment building and the horticultural laboratory are to be finished October 1, 1888.

From the present outlook there will be no application to the next Legislature for new buildings, and all we shall need from the Legislature is the ordinary expenditure incident to the repairs and the running of the heating and motive power, and the equipment of the laboratories, utensils on the farm and garden, and the necessary increase of the library, all of which items I can not here specify. We shall probably want nothing for construction. We shall need in the near future a foundry shop in connection with the mechanical building, but we shall try to dispense with it as long as we can. We had expected to ask for an appropriation for a hospital, as experience has shown that such a building is very necessary. But we have succeeded fortunately in securing a vacant farm house in the vicinity, which for a moderate rental, will answer our purpose. Of course this can only be a temporary arrangement, but it will do for the present.

I need not assure you that we all look forward to the completion of the buildings as a relief from the crowded condition of things, both students and subordinate teachers, and the executive of the college, and we can but express our gratitude to the Legislature for its appreciation of our wants.

AGRICULTURAL COLLEGE, MICH., June 30, 1888. EDWIN WILLITS.

REPORT OF THE PROFESSOR OF AGRICULTURE AND SUPERINTENDENT OF THE FARM.

To the President of the College:

DEAR SIR,—I herewith submit my report of the work of the Agricultural Department for the College year ending June 30, 1888.

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INSTRUCTION.

I have no changes to report in the plan of work, or methods pursued during the year; as my views on this topic have been given at length in former reports. The Freshman class during the spring term had evinced a good interest in their work which was suddenly terminated by the unexpected adjournment of the College some two weeks before the scheduled time on account of the fear of contagious disease. The class was passed on the regular work, however. The Sophomores during the fall and summer terms pursued the work assigned them and with some few exceptions have been passed in the same.

The whole number who have received instruction in this department during the year is as follows: Freshmen 50, Sophomores 52, total 102.

LECTURES AND INSTITUTES.

I have taken my regular assignment of the Wednesday afternoon lectures and also attended the Farmers' Institutes at Ithaca and Tecumseh. I also presented a paper on Silos and Ensilage at the annual meeting of the State Dairymen's Association held at Adrian, and as President of the Michigan Short Horn Breeders' Association I presented an address at the annual meeting of that organization in December. I also read a paper, by invitation, before the annual meeting of the Michigan Merino Sheep Breeders. I have also prepared Bulletins No. 30, on the "Feeding of steers of different breeds," and also No. 34, giving results of experiments with potatoes and oats.

I attended the seventh annual meeting of "Teachers of Agriculture and Horticulture," held at Champaign, Illinois, in July. Hon. E. W. Rising, by appointment of the Board of Agriculture, accompanied me. These meetings, which the constitution provides shall be held at some one of the agricultural colleges annually, are designed to bring together those engaged in these lines of work for informal conferences as to the methods adopted, the difficulties met and how overcome. The discussion of methods, the inspection of buildings, appliances, fields, crops, implements, etc., at other colleges must be suggestive and help to better practice.

It seems to me this association has met a felt want on the part of those engaged in this work and not met by any other organization.

NEW IMPLEMENTS.

An Aspinwall potato planter has been purchased of the Aspinwall Manufacturing Company, of Three Rivers, Michigan; a wheelbarrow, clover and grass seeder was purchased of O. E. Thompson, of Ypsilanti, Michigan; also a fertilizer sower of C. W. Bradly & Co., of East Bloomfield, N. Y.; and a Marseilles corn cultivator, manufactured at Marseilles, Illinois.

PERMANENT IMPROVEMENTS.

The new silo referred to in my last report was completed and filled in September. The ensilage was most excellent, largely made from corn cut when the ears were in the milk, and has been fed with increasing satisfaction. I append a description of the silo.

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SILO.

The dimensions of the new silo built at the College last summer are 18x30, with a partition in the center, making two silos, each 15x18 outside measurement, and with a total capacity of 150 tons. The silo is located on the north side of our cattle barn, which has a basement stable. We excavated some six feet to have the silo floor on the same level as the stable floor. The excavation is walled up to the surface with stone laid in ordinary mortar —a good 18-inch wall. Doors open from each silo into the feeding room, adjacent to the stable and on the same level. On this wall sills made of plank are bolted, and joists 2x12 and 16 feet long were used for studding and placed one foot apart. On the outside ordinary stock boards battened and painted with two coats made the finish. On the inside the studding was first covered with shipping culls, put on horizontally. On these a layer of tarred paper, then a second covering of boards was put on perpendicularly. This was lathed and plastered with water lime cement. The floor is just as left when the excavation was finished. A good shingle roof, with a window and outside door in each silo—the latter for putting in and taking out the materials for weighting—completes the building. The ensilage would have kept just as well without the cement coat. We put that on to preserve the boards. Kept constantly wet, they will soon decay where the ensilage is placed next to them. The cost of the silo was $430.00. As a hay barn it would hold eighteen tons. This silo has a capacity equivalent in feeding value to fifty tons of hay.

NEW BRIDGE.

A substantial new iron bridge has been placed over the Cedar river by the Smith Bridge Co., of Toledo, O. This not only adds greatly to the appearance of our farm lane, which we are making quite a boulevard, but gives us a safe passage way, instead of what we have felt was a dangerous one with the old bridge.

EXPERIMENTS.

The experiments made have embraced feeding steers of different breeds, testing wheat, oats, and potatoes of different varieties, feeding ensilage and warming water for stock. These have been reported from time to time in bulletins issued.

The steers of different breeds were shown at the Chicago fat stock show and attracted much attention. They are doing well at present and it is our intention to exhibit them at the State and district fairs this fall, and then at the fat stock show where they will be slaughtered for examination of carcass.

I have been authorized by the Board of Agriculture to obtain calves for the repetition of the experiment just mentioned. It is gratifying to know that our breaders are taking a lively interest in these experiments, and are ready to place the calves here, for the purpose, at most reasonable terms. The Herefords will come from the herd of Merrill & Fifield, Bay City, and Hon. William Crapo, Flint, John W. Foster, Supt., Mr. M. L. Sweet, Grand Rapids, President of the National Holstein Fresian Association, will furnish one of the Holsteins. Messrs. R. B. Caruss of St. Johns and Townsend & Wickes of Colby will furnish the Galloways.

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Objection is sometimes made to the limited number of animals in the test, and some are of the opinion that eight or ten animals of each breed should be secured to make such a trial of value.

I am of the opinion that experience will show that it is impracticable to feed so large a number together and have the details of management as carefully observed as is necessary to secure accurate results. It seems to me that a number of tests must be made, and the average of the results secured will be most reliable. In other words, five tests with two animals of each breed will be worth more than one test with ten of each breed.

At the annual meeting of the Michigan Merino Sheep Breeders, I suggested that it would be a good experiment to feed some lambs of different breeds in a similarly conducted test to the one now under way with cattle. This seemed to meet with favor, and Hon. John T. Rich, of Lapeer, introduced the following resolution which was unanimously adopted:

Resolved, That Prof. Sam'l Johnson be requested to invite owners and breeders of the different breeds of sheep to contribute one or more lambs or wethers of their respective breeds, to be fed experimentally by Prof. Johnson under substantially the same conditions as he is now feeding the steers of different breeds; the object being to show the relative benefit to be derived from the different breeds; feed, value of fleeces and carcass considered.

Mr. Rich has recently assured me that he would see that the lambs were secured of the Merino breed, and Hon. James M. Turner of Lansing has promised to see that a pair of Shropshires is procured. I presume other breeds will be represented.

Some of our swine breeders have been anxious for a test of different breeds and we now have planned to feed a pair of Berkshires bred by J. W. Hibbard, Bennington Mich.; a pair of Duroc Jerseys bred by Mr. Quincy McBride Burton, Mich., and a pair of Poland Chinas from some reliable herd. These will be fed in adjoining pens and careful records kept of food consumed, gains made, etc.

EXPERIMENT STATIONS.

Early in the spring the Board of Agriculture appointed two of its members, Messrs. Chamberlain and Horton, a committee to visit some of the leading agricultural colleges and experiment stations for the purpose of learning what lines of dairy experiments were being carried on and what were the plans for future work, that we might have the benefit of their experience in deciding upon a line of dairy experiments at this station.

Business prevented Mr. Horton from taking the trip and I was appointed to go in his stead.

The report of the committee will be found in the report of the experiment station.

While our main object was to learn of dairy experiments, we availed ourselves of the opportunity to see all we could of other lines of experiment and of the work in all departments of the colleges we visited. A few points in this connection may be of general interest.

At the Wisconsin University we found no agricultural students, but both Prof. Henry and Dr. Babcock, the chemist, were much pleased with a short winter course which was attended last year by some twenty young men.

President Chamberlain, of Iowa, gave us what time he could spare from a

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previous engagement and Capt. Speer, the director of the station, explained in detail his plan of horticultural experiments. Prof. Halstead, professor of botany, who is a graduate of this College, explained his methods of work, with which we were much pleased. We were greatly interested in Prof. Budd's narration of his success in introducing Russian varieties of fruit into Iowa. His words and, better still, the ocular demonstration he gave us in the shape of well formed, vigorous trees that had withstood the severe winters of Iowa and were ready to blossom, while the native varieties were generally killed, and his description of the appearance and quality of the fruits lead us to think he has done the horticulture of the northwest a service which will be more and more appreciated in the future. Prof. Smith, the recently elected professor of agriculture, showed us about the farm buildings. The changes in this department during the three or four years past have not been conducive to improvement, but Prof. Smith hopes to develop the department and give it the place and reputation it should have in a great industrial and agricultural school.

President Mills, of Guelph, kindly showed us the various departments of this well managed institution. We were much pleased with the work of Prof. Panton, who has botany, physiology, geology and entomology, and seems to handle all of them in admirable shape. We visited the experimental grounds with Prof. Brown.

We were indebted not only to Prof. Roberts, of Cornell, but to Mr. Joseph McGraw, of Ithaca, for a pleasant visit at Cornell University and station.

At Amherst, Mass., the first official we met was Prof. Maynard, who has charge of the horticultural department. He has 75 acres in charge; this includes the grounds, fruits, vegetable gardens and greenhouse. He assured us that the department is largely self-supporting. While labor is not compulsory he finds it expedient to employ students. With this system only those work who wish, and so are willing to earn their wages. Prof. Maynard finds such assistance very satisfactory and puts the management in part in their hands.

We visited the Professor's laboratory, for he teaches the botany in addition to his other duties, a plain building but well adopted to his use. His apparatus for illustration was arranged in what seemed to us a very practical and effective way.

We saw the orchards, vineyards, gardens, experimental plats, etc. and were struck with the extent, order and business like thrift apparent everywhere.

At Pres. Goodell's office we had the pleasure of meeting Secretary Sessions of the State Board of Agriculture and Mr. Stedman of the farm committee. Under the escort of these gentlemen we were shown the chapel, library, farm buildings and stock.

I cannot forbear expressing, in this connection, my decided conviction that visits of this sort by members of the Board and faculty to similar institutions and Experiment Stations, and which you, Mr. President, strongly favor, must be conducive of great good to our own institution. If we are doing good work in our several departments, as shown by comparison with similar work in other institutions, it will be a source of encouragement and the man must be dull indeed who does not get many valuable suggestions from such visits. To measure ourselves by ourselves or among ourselves is not wise. We shall be more likely to get our true stature and status by looking at work a little more remote and where there is less of the glamour of self or mutual approval. So, too, as members of the Board a careful inspection of methods, work per-

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formed and results secured in similar institutions could not fail to be wonderfully suggestive and helpful in deciding many of the puzzling questions that Boards of control are called upon to determine.

I wish to express my hearty appreciation of the opportunity afforded me, by this trip, to look over fields of work in other colleges, and feel that it must be very helpful to me.

CATTLE SALE.

The fourth annual sale of cattle from the College farm was held on April 18th; 15 Short Horns and 5 Herefords were catalogued.

The day was pleasant and the attendance fair. Some of the bulls offered were too young to meet the demand of buyers and were not sold.

The following is a list of the animals sold, purchasers and prices paid:

SHORT HORNS.

Gladstone, Wm. Toan, Maple, Mich.	$105 00
College Alice 3d, Wm. Steele, Ionia, Mich.	60 00
Violet B., Wm. Steele, Ionia, Mich.	190 00
Hela 5th, F. H. Baker, Detroit, Mich.	140 00
College Mysie, W. E. Boyden, Delhi Mills, Mich.	205 00
College Crystal Queen 3d, R. W. Edling, Menominee, Mich.	140 00
College Roan Duchess 2d, J. L. Harris, Eckford, Mich.	105 00
College Peri Duchess 3d, Wm. Steele, Ionia, Mich.	210 00

HEREFORDS.

Miss Agincourt 3d, Wm. Steele, Ionia, Mich.	$180 00
Daisy 3d, with cow calf at foot, J. M. Turner, Lansing, Mich.	110 00

The average for the animals sold was higher than at any previous sale.

STOCK ON HAND JUNE 30, 1888,

exclusive of that owned by the Experiment Station, 6 work horses, 61 head of cattle, embracing:

Short Horns	40 head.
Herefords	2 "
Holsteins	4 "
Ayshires	2 "
Devons	5 "
Galloways	1 "
Jerseys	1 "
Cross Bred	6 "

RECEIPTS FROM FARM

during the year will be found in the Secretary's account, page 15 of this volume.

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Cropping List for 1887.

Field.	Area.	Crop.	Quantity.	Remarks.
3	23			
	13	Meadow	18 tons	
	10	Experimental crops	894 bushels roots 244 bushels of potatoes.	Experimental Crops. " "
5	20			
	5	Meadow	4½ tons	
	15	Wheat	363 bushels	
6	27	Meadow	46½ tons	
8	23	Meadow	29½ tons	
9	23	Oats	1,208 bushels	
10	22	Corn	357 bushels	
11	23	Corn	574 bushels	
	¾	Potatoes	30 bushels	
14	3	Meadow	2¼ tons	
	5	Wheat	84 bushels	

STUDENT LABOR.

I have in former reports expressed my views as to the benefits resulting from that system of manual labor which the organizers and early friends of this College believed was essential to its largest success, and to which policy all Boards of Control have faithfully adhered.

There is no question but that the decided adherence to this system of manual labor has done more to give this College reputation at home and abroad than any or all other of its elements of strength.

We do well to give earnest thought to how we may best retain and utilize that which has given us such prestige. We shall not do it by wordy expressions of loyalty to the system. The sentiment is good, but to be of value must be emphasized by hearty, vigorous enforcement of the labor rules and consistent support of the men who have to do with this perplexing question.

I repeat what I have before said: "There has seemed to be a growing tendency to look upon the labor system as a part and parcel of the farm and horticultural departments, and that these departments are to be held strictly to account for all the mistakes of the system, the adjustment of which is the most difficult and perplexing of all our college work. While the farm and horticultural departments have the direct oversight of this labor and should in no wise shirk any responsibility which consistently attaches thereto, it can only fairly be said that they, in common with each and every department, are responsible for its success or failure, no more, no less. The rules of labor are made by the faculty, and all departments have equal voice in these. It is not the labor system of the horticultural or farm departments, but it is the labor system of the Michigan Agricultural College."

Two or three causes have, in my opinion, greatly increased the difficulties with which those in charge of student labor have had to contend in recent years.

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The first, is the growing sentiment among students that the labor system is carried on for the benefit of the Farm and Horticultural departments, that these are pecuniarily the gainers by having the student labor. In other words, the student too often has the impression that he is conferring a favor, enriching the farm by giving his labor for less wages than other help would receive. I am sure a good many well intentioned students misapprehend the facts here.

Students should be made to see clearly that the labor system is a loss pecuniarily to the farm. All the work could be performed more cheaply by skilled labor that could be employed the whole day—than by so large a number of students that we hardly know how to manage them for the brief time they labor or how to prosecute or complete the half finished work they leave which cannot be postponed.

Students should be made to feel that the work system is adhered to and practiced at this College *solely in their interest*, and that it becomes them to show their obedience to the law of the State, which has enacted that this work shall be performed and their appreciation of the privilege of earning a part of their necessary expenses, by rendering cheerful, faithful service.

Intimately connected with this mistaken idea and fostering it has been the unwise, unqualified talk about the farm and garden being great laboratories where the labor was all to be educational. This idea, usually assuming the form of an indirect criticism of the management of farm or garden, has done more than anything else to foster the whims of students, encourage their prejudices and make them captious and dissatisfied. Those who talk in this way seem to have forgotten that farm labor, much of it, has to be repeated and cannot have the charm of novelty each day.

I believe that so far as we can make it so all the labor performed shall be under such direction as to make it in a *right sense educational*. But the first *step in this direction is to see that the student makes an honest, cheerful effort to earn his wages*. If he is helped to do this he is being educated for usefulness, good citizenship. No fine spun theories, no wise and capable instruction, with the best facilities, will avail. An honest, cheerful effort to earn his wages must precede and will develop the teachable spirit, without which no real education can come to the student from his work. This is primary, of first importance. When the student gets the idea that his labor, *for which he expects full pay*, must be varied daily, be easy, clean or to suit his notions, he is very likely to be tardy, inattentive, by word and example impressing his fellow students with his own prejudices, to their great harm. With such a spirit no work in which he can engage could be truly educational.

There should be more care taken to make the proper distinction between paid and unpaid labor. If the zeal of some of the self-appointed champions of our labor system could be moderated by more knowledge of the facts involved and the baneful results upon students of their exaggerated and impracticable thories, if they would only make the proper distinction between paid and unpaid labor, when discussing the labor system with students, they would do much less harm. Consistent, common sense, every day support alone will keep the labor system in good repute, and lighten the burdens of those who have it in charge.

I do not hesitate to say that every true friend of the College, every believer in our labor system, will unite with me in saying that those in charge of the labor are entitled to such support.

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Nine years of experience with the labor system has given me at least some opportunities to know of its value, of the difficulties which those must meet who endeavor honestly to carry out its provisions. I have by no means always reached my ideal in its management here, but I may say in all good conscience that no one can be more willing to labor for the removal of the difficulties, the more perfect development of the system until a greater fruitage of practical good shall be realized by all who are here for instruction. There may be differences of opinion as to the best way to make the system more truly educational. There should be no differences in our desires to have all reasonable expectations of its value realized.

MORE ASSISTANCE NEEDED.

The increasing work of this department, taken in connection with the experimental work under the Hatch appropriation just received, leads me to think that a word as to the assistance allowed the department of Practical Agriculture may not be out of place.

Nine years ago, in 1879, when I came to my present position, I found a farm foreman and an assistant foreman employed. These two assistants had been employed for some years in the department by my predecessors. After a year of trial I came to the conclusion that the assistant foreman, as such, was not needed, and that the work he was doing could be done as well by the senior class students and greatly to their advantage.

This plan was approved by the Board of Agriculture and followed with, I think, very good results until the Board came to the conclusion that this privilege of employing senior students at extra compensation was being abused, and that an excessive number of student supervisors was being employed in one department, and decided to abolish the rule allowing extra compensation for such service.

In justice to myself, I wish to say in this connection, that the records will show that the farm department was not culpable in this matter of the indiscriminate and unjustifiable employment of senior assistants. Might it not have been better to have put checks on the offending party, rather than to have abrogated the rule?

Since the abrogation of the rule, I have employed one assistant who has devoted his time mainly to the supervision of student labor, and has aided in the field experiments we have undertaken. No other extra help has been employed; so that up to date, with the increase of work and increased responsibility of experimentation, I have no more help than was employed ten years ago. It may be added in this connection, that I have one half term more of teaching than formerly.

In some of the departments of the College, where so far as I am aware, there has been no greater legitimate growth or increase of work than in my own, departments have been divided and two professors are employed, with from one to three assistants, to do the work formerly done under one head. I do not note these facts in any spirit of complaint or criticism. I do not think I have ever complained of over-work or of the lack of assistants, but I wish to call the attention of yourself and the Board of Agriculture to these facts, and to respectfully suggest that in planning for future work, there should in justice to the Agricultural department be a more equal distribution of assistants.

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AGRICULTURAL LABORATORY.

You will remember, Mr. President, that with the completion of the Horticultural Laboratory, for which appropriations were made two years ago, each of the special departments, *except that of Practical Agriculture*, will be provided with a building erected for and adapted to the uses of that department. Is it not time to remember the agricultural department in a similar way? Would not a good building dedicated to practical agriculture be most emphatic evidence of the intention of those in authority here to foster, encourage and equip this department so that it shall not for want of equal facilities fall in the rear of other departments?

CONCLUSION.

In conclusion, I wish to express my sincere appreciation of the services of those who have assisted me in the work of the department.

Mr. Wm. Brown, herdsman, has, in addition to his customary duties, rendered us valuable service in some of the experimental work with animals.

Mr. Henry Munn, farm foreman, has shown his ability in the thorough manner in which he has cultivated the farm. The fields and crops have never been managed more to my satisfaction.

Mr. H. T. French, who devotes a good part of his time to the supervision of student labor, has also supervised in good part the field experiments we have carried on in a very commendable way.

For the continued confidence and support of the Board of Agriculture in the discharge of the perplexing duties of the year I wish to record my most hearty appreciation.

Respectfully submitted.

SAMUEL JOHNSON,
Prof. of Agriculture and Supt. of Farm.

AGRICULTURAL COLLEGE,
June 30, 1888.

REPORT OF THE PROFESSOR OF HORTICULTURE AND LANDSCAPE GARDENING.

To the President of the College:

The nine months which have elapsed since my last report was submitted have brought prosperity to the department under my charge. My work has been pleasanter than heretofore, owing to added facilities. The department is now, for the first time, in respectable running order. Two good teams, good tools, and the subjugation of certain areas within the limits of the horticultural department, make the work much more satisfactory than it has been before. Many rough and troublesome portions of the grounds have been brought into good condition, and sufficient drainage has been done to make the land, both in lawn and crops, easy of manipulation. In short, most of the pioneer work upon the department has now been done, and very

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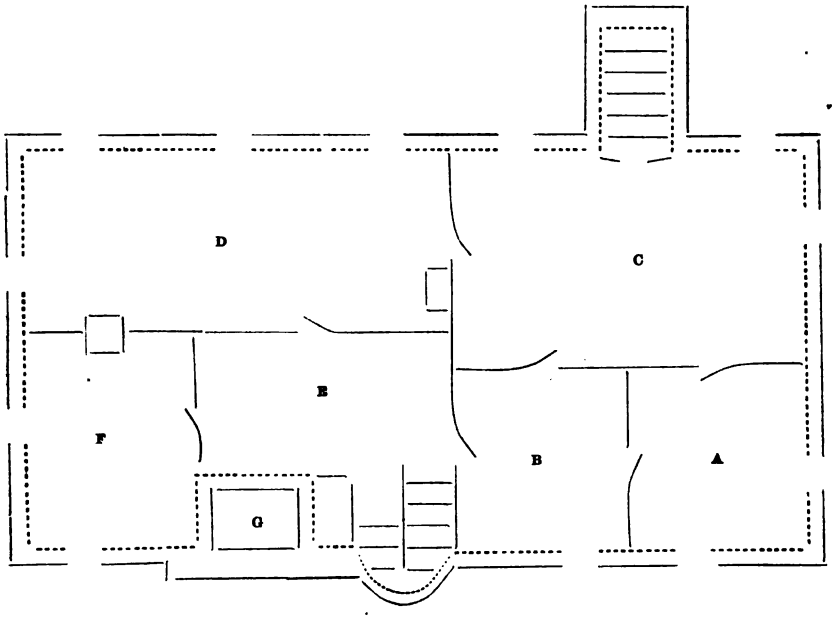
many of the unpleasant features of the duties imposed upon the department have been overcome. The horticultural building is nearing completion. Upon the whole this building is well planned, although certain minor changes made by the architect from our original plans impair its utility in some directions. This is the first distinctively horticultural laboratory in this country. Many inquiries concerning the details of its plans have been received, and it therefore seems worth while to add here an outline plan of the building. The building is about 36x68 feet, two stories and basement, veneered with brick. Its cost is about $6,000.00.



Basement.

Rooms A and B, basement, are storage-rooms for fruits and vegetables. C is a general marketing-room, with cement floor. D is an operating-room, for grafting, etc., board floor. E, hall. F, heeling-in cellar, with sand floor. G, storage-room.

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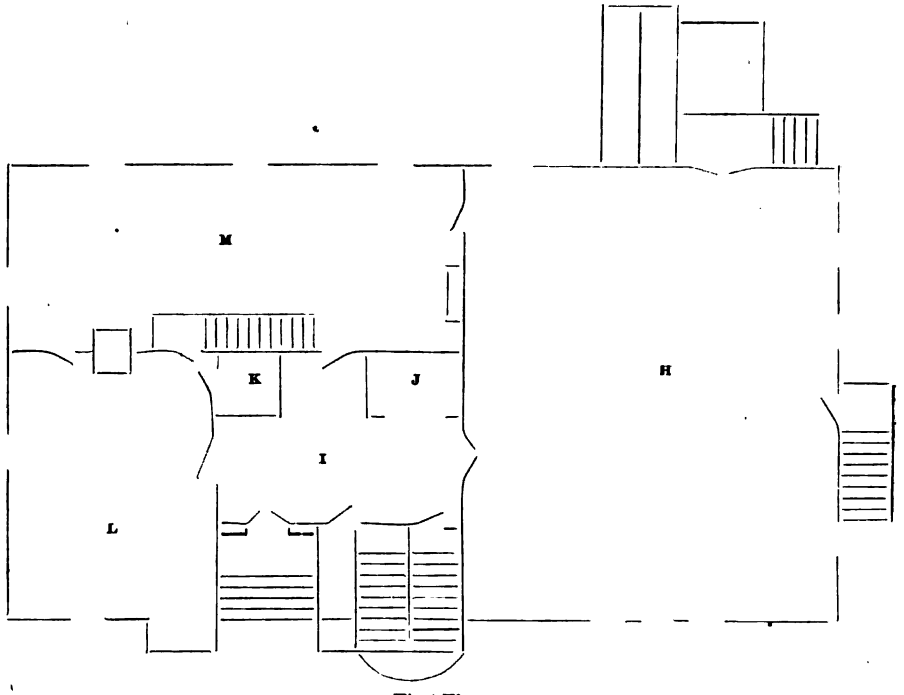
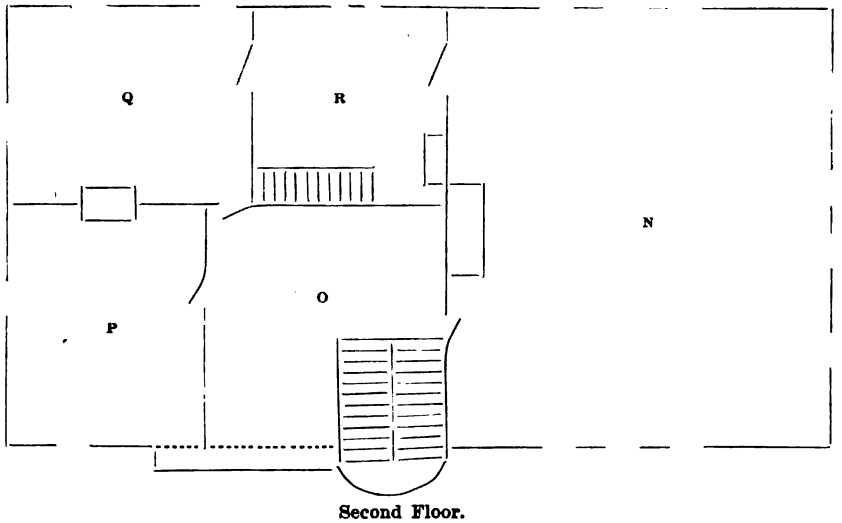


First Floor.

H, first floor, is a tool-room, for hand tools, ceiled. I, hall. J, closet. K, dark-room for photographic work. L, office. M, carpenter shop, ceiled.



Second Floor.

N, second floor, class-room, finished up on the rafters. O, hall, to be used also for museum cases. P, seed-room, to be used also for work by one or two advanced students. Q, laboratory room. R, storage and museum room,

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for keeping specimens for class illustration. A private stairway from the office below opens into this room.

But despite the fact that much of the pioneer work of the department has been done, there yet remain many annoyances and burdensome features which could easily be remedied. By far the greater part of the work of the professor of horticulture is concerned with matters which are not strictly horticultural. The scavenger and errand work of the institution, at least, should not be imposed upon this department. It has been impossible, heretofore, to conduct consecutive experiments requiring close application because of the unprofessional work heaped upon the department, and, even with the present improved facilities, this difficulty is far from being removed. There has not even been time to devote to any of the niceties of gardening. The greenhouse should be a part of the equipment of the horticultural department. To attempt to conduct horticultural work in these days without a greenhouse is to work at a disadvantage at every turn, and to fail to reach the common status of even commercial gardening.

In consequence of a feeling of economy, the department was refused two teamsters last winter and one team was obliged to stand idle. This idleness was the more unfortunate as the gardens and orchards need all the manure which two teams can haul. Half or more of the time of one teamster is required to do the winter jobbing about the grounds, and little manure was therefore secured last winter. Some means should be provided for irrigating the gardens, or portions of them. This is essential for experimental work, as the loss of a season's experiment often becomes a serious matter. Upon the grounds the chief permanent improvements needed are a number of asphalt or coal-tar walks. One is particularly needed between College and Wells halls. A new field mower is needed, and a one-horse field mower is a desideratum. Particular attention has been given to student labor, and I feel more strongly than ever the need of more supervision. This supervision should be provided from the senior class, and could be had for a trifling additional expense.

DONATIONS FOR THE YEAR ENDING JUNE 30, 1888.

Prof. J. B. Steere, Ann Arbor, Mich.:
Seeds of a wild dewberry from British Columbia.
E. A. and P. G. Holden:
Plants of a thornless wild blackberry.
J. W. Van Deman, Benzonia, Mich.:
Pits of Prunus purnila.
Mrs. Henrietta L. T. Wolcott, Dedham, Mass.:
Seeds and buds of amber fruited Prunus Virginiana.
R. S. Williams, Great Falls, Montana:
Seeds of Psoralea esculenta.
N. B. Hall & Co., Benton Harbor, Mich.:
A full line of samples of fruit packages.
Cleveland Nursery, E. Rockport, Ohio:
Plants of Thompson's early prolific raspberry.
Plants of Thompson's Early Pride red raspberry, and Thompson's Early Mammoth blackberry.
P. M. Augur, Middlefield, Conn.:
Plants of gold, cardinal and No. 70 strawberries.

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H. Beyer, New London, Iowa:
Plants and seeds of upland cress. Also various grass seeds and garden seeds.
Prof. C. C. Georgeson, Komaba, Tokio, Japan:
Seeds of a wild raspberry, and various Japanese garden esculents.
Dr. Chas. E. Bessey, Lincoln, Nebraska:
Pits of prunus purnila and P. dernissa.
D. B. Wier, Lacon, Ill:
50 trees of native plums.
Arnold Arboretum, Brookline, Mass., per B. M. Watson, Jr., and W Deane:
Cuttings of many species of Ribes.
L. H. Bailey, South Haven, Mich.:
Scions of apples.
Wm. K. Emmons, Byron Center, Mich.:
Scions of the Mother apple.
Vilmorin Andrieux et Cie., 4 Quai de la Mégisserie, Paris, France:
Seeds of many interesting and valuable esculent vegetables.
Hiram Sibley & Co., Rochester, N. Y.:
Seeds of Sibley squash.
Department of Agriculture, Washington, D. C.:
Seeds of red and white onions from Teneriffe. Various garden seeds.
Byron G. Stout, Pontiac, Mich.:
Scions of the Oakland (Seek-no-further) apple.
W. Atlee Burpee & Co., Philadelphia, Penn.:
Seeds of various new and interesting vegetables.
Agricultural Experiment Station, Geneva, N. Y.:
"Station" pea.
J. Schneck, M. D., Mt. Carmel, Illinois:
Cuttings of Vitis riparia, V. æstivalis, V. palmata, V. cinerea, V. cordifolia.
A. W. Smith, Americus, Georgia:
Seeds of three sorts of moonflower.
James B. Wild & Bros., Sarcoxie, Missouri:
Tree of Moore's Ruby apple.
John H. Evans, Lewiston, Idaho:
Scions of the Idaho pear.
A. I. Root, Medina, Ohio:
A nest of transplanting tubes.
Dr. E. Lewis Sturtevant, So. Framingham, Mass.:
Seeds of Capsicum umbilicatum.
Benj. Hathaway, Little Prarie Ronde, Mich.:
Nuts and scions from select chestnuts.
D. F. Ewen, Pinckney, Michigan:
Seeds of orach.
J. M. Thorburn & Co., New York:
Seeds of new everbearing cucumber.
Dr. T. H. Hoskins, Newport, Vermont:
Scions of Russian apples and pears.
Thos. Crane, Fort Atkinson, Wisconsin:
Two new varieties of potato—June Eating, and Extra Keeper.
Prof. James Cassidy, Fort Collins, Colo.:
Numerous varieties of potatoes.

L. H. BAILEY,
Superintendent.

AGRICULTURAL COLLEGE,
June 30, 1888.

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REPORT OF THE PROFESSOR OF CHEMISTRY.

AGRICULTURAL COLLEGE,
June 30, 1883.

President Willits:

I herewith submit my report for the Department of Chemistry for the College year. In doing so it gives me pleasure to report a very successful year in my department, both in class-room exercises and in laboratory work. The students have been attentive and orderly in their behavior and enthusiastic in their work.

In former reports I have spoken of the amount and kind of work done in this department, and I need not recapitulate at this time. It is sufficient to say that the amount of work both on the part of the students and of the teachers has not diminished, and the demands of the public for assistance and research in the line of chemistry, as related to public health and individual safety, have increased steadily from year to year. In this way the College is constantly brought into more intimate relations to the public, and its value as one of the institutions of the people is more clearly recognized.

In closing this brief report of the chemical department I cannot refrain from expressing my thanks for the hearty and generous support I have received from you in every effort I have made to render the College more helpful to the student, and more valuable to the public.

R. C. KEDZIE,
Prof. Chemistry.

REPORT OF THE PROFESSOR OF ZOOLOGY AND ENTOMOLOGY.

President Edwin Willits:

In presenting the following report of my department, I wish to express my pleasure and gratfication at the evident progress everywhere manifest. The students of my large classes have been, without exception, earnest, faithful, orderly and punctual. The classes have numbered from twenty-five to forty. The laboratory practice, which varies from six to fifteen hours per week, is more and more satisfactory. The one need in the department of instruction now, is enlarged museum and more extensive cabinets. I wish to express my grateful acknowledgments of the valuable assistance received from Prof. C. P. Gillette, now of the Iowa Experimental Station, and from Mr. F. H. Hillman, my present assistant, whose faithful services have done much to make the laboratory work of more interest and value to the students.

COLLEGE WORK ASIDE FROM INSTRUCTION.

During the past year I have given one lecture before the College as a whole, and attended during the winter four Farmers' Institutes, before each of which I gave two addresses.

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The correspondence of the department grows larger each year. It often takes me hours to answer the letters of a single mail. These refer to insects and other topics germane to my professorship. Each letter always receives prompt attention.

THE APIARY.

During the past year the new apiary has been completed, and the bees have been removed to their new quarters. They were put into winter quarters in the new cellar in fine condition: but either owing to the fact that the buildingwas completed late in autumn, or else from faulty construction the temperature in the cellar, which is wholly underground, fell to twenty-six degrees and stood at 28° for several weeks. To winter well the bees require that the temperature should stand between 35° F. and 45° or 50° F. Again, owing to some fault in the drain, the cellar was flooded and many of the hives were nearly submerged, and some were turned bottom up. Thus more than half of our bees died during the winter. This was a unique experience, for of late our bees have invariably wintered well. Indeed in our old bee-cellar, our losses were almost nothing.

During the present year, the honey harvest has been exceedingly poor, worse even than last year. This is true nearly all over the United States, and also in nearly all parts of Europe. We secured no honey at all, except barely enough for the bees, till autumn. We hope to get enough of late honey to winter our bees, but are not sure of that. The apiary has now been turned over to the Experimental Station, and the experiments which are under way in reference to special planting, bee-plants, and cross-breeding, will appear in the report of the station.

EXPERIMENTS.

Owing to the fact that my assistant was called away early in the season, I have been unable to do the experimental work that I should have liked to do. I tried again the effect of the arsenites as a specific against the codling moth, making the application once, twice and three times, the first just as the blossoms fell, the second two or three weeks later and the third two or three weeks later still. Results show that the second and third spraying was profitable, as more apples were saved from the attack. This is easily explained in view of the frequent rains. We used one pound of London purple to one hundred gallons of water. Trees treated once, while they have more wormy apples, were not at all injured in foliage. Trees treated twice have less apples injured, but the foliage was considerably scorched, though the mixture was the same strength as that used the first time. The trees which were sprayed three times, while they have still less injured fruit, show still more damaged foliage. This injury is somewhat surprising. The strength of the mixture was the same in each case and the thoroughness of the application was as nearly the same in each case, as we could make it. Heavy rains occurred between times, which we should suppose would have washed all the mineral off that had been previously applied. Either this is a case where the last straw broke the camel's back, or else some difference in temperature, rain or moisture caused the difference.

We also used the same mixture three times on our plum trees and saved

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a good crop. The curculio commenced in force on the plums, but ceased after the spraying. This result is quite different from that of former years, possibly owing to three applications instead of the one previously made.

We also threw plaster and lime, to which was added a gill of crude carbolic acid to a gallon of the mineral. This was also used three times, each time after a heavy rain, and was as effective in saving the plums as was the London purple. We also found it quite as easy to apply it—use being made of a tall step ladder. The plaster is much pleasanter to use then is the lime, as it flies less when mixing and when applying it to the trees. Hereafter I shall use the plaster exclusively.

This year we saved radishes from attack by the maggot by covering with cloth in cold frames. I have further proof, too, that the maggots which attack the onion, cabbages and radish are identical. From experiments tried it would seem that we may save our onions by planting radishes among them.

Buhach or California pyrethrum was used effectually against the rose chafer and blister beetles. As we should expect, several applications must be made on successive days. The powder may be applied or it may be mixed with water, a heaping tablespoonful to the gallon.

Experiments were made to kill ants. We tried to poison them by feeding poisoned syrup kept in a close box covered by wire gauze, which, while it would admit the ants, would not, from the size of the meshes, permit the bees to enter. This did not succeed, as the ants would not eat the mixture. I have previously used this method very successfully to poison ants about bee-hives early in spring. The other method was by use of bisulphide of carbon, and was found, as it has been previously, a very speedy and efficient way to slaughter ants. A hole is made in the ant hill or mound by use of an iron rod or crowbar, a gill or so of the liquid poured in and then all quickly covered by clay, and this last well packed down. This confines the liquid, which rapidly volatilizes and kills all the insects.

These experiments were performed under the auspices of the Experimental Station, and will be more fully detailed in its report.

OUTSIDE WORK.

During the past winter I thoroughly revised and greatly enlarged my Bee Keepers' Guide. Many new and costly illustrations were also added. The work now contains about 500 pages, and is perhaps the most thoroughly scientific and practical of any work extant. The 13th edition (15th 1,000) was issued the past summer. I also spent two weeks the past winter lecturing in Wisconsin before the Farmers' Institutes of that State. I a attended the North Amerian Bee Keepers' Association at Chicago, where I gave an illustrated address on the anatomy of the bee. I attended the annual meeting of the Michigan Horticultural Society, of the Michigan Bee Keepers' Association and the Michigan Dairymen's Association, before each of which I read a paper. I have refused invitations to address several farmers' meetings owing to the fact that my duties here would not permit. In the early spring I addressed the Stock Breeders' Association, of Shiawassee county, of which I was elected President.

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DONATIONS TO ZOÖLOGICAL DEPARTMENT.

W. B. Alwood, Columbus, Ohio:

Mud hen.
American wigeon.
Blue winged teal.
Lesser scaup duck.

C. B. Cook, Owosso, Michigan:

Woodchuck.
Yellow backed warbler.
2 Bluebirds.
Black snow bird.
Fox sparrow.
2 White throated sparrows.
4 Snow buntings.
2 Purple finch.
Shoveler.
Yellow bird.
Song sparrow.
Scarlet tanager.
Great crested fly catcher.
Whippoorwill.
Bald eagle.
2 English sparrow.
2 Rusty grackle.
Red winged blackbird.
2 Hermit thrush.
2 Gold crested kinglet.
White bellied nut hatch.

J. F. McCamant, San Antonio, Texas: 17 Gasteropod shells.

James Turner, Lansing, Mich.: 2 Cores of rock from diamond drill.

Mrs. M. S. G. Narvin, Lapeer, Michigan:

Chlorite with crystals of pyrite.
2 Shales.
4 Quartzite with crystals of pyrite.
Actinolite.
2 Hornblendic trap.

Dr. C. C. Miller, Marengo, Ill.: Iron ore; 2 porphyry.

A. J. Cook, Agricultural College, Mich.: Travertine and stalagmites.

Dr. W. J. Beal, Agricultural College, Mich.: 50 leeches; 4 helix shells.

Mrs. A. F. Hillman, San Diego, California:

4 Mica.
2 Star fish.
20 Bivalve shells.
1 Sea urchin.

L. G. Carpenter, Fort Collins, Colorado:

Lava.
Oily earth.
Gold ore.
Graphite.
Porous rock.
Native sulphur.
8 Silver ore.
2 Teluride.
3 Gold (native).
3 Galena ore with copper.
Fossil wood.
Granite.
2 shells (molluscan).
2 Ores.
5 Gold ore.
Sulphate of magnesia.
Sand carbonate.
Bicarbonate of soda.
Hydraulic cement.
Red hematite.
2 Oxide of iron.
2 Gypsum.
2 Peacock ore (silver).
Gold and silver ore.
Twigs.
2 Iron pyrites.
Coarse green copper.
Lead and quartz.
Leadville ore.
Ruby silver.
Knife blade crystals.
Galena ore.
Silver, copper and lead ore.
Copper ore.
Leadville ores.
Cuttle bone (Belemnites).
Quartz crystals.
Spirifer.

Miss Katie Cook: Young gar pike.

Robert Cissum, Hagenam, Indiana: Honey dew.

AGRICULTURAL COLLEGE, MICH., September 1, 1888.

A. J. COOK.

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REPORT OF THE PROFESSOR OF BOTANY AND FORESTRY.

To Hon. Edwin Willits, President of the State Agricultural College:

The following is my report for the year just closing:

During this period, one hundred and twenty-two have received instruction in structural botany, fifty-two in systematic botany, thirty-seven in physiological botany, fifty in forestry, thirty-seven in the use of the microscope as applied to the structure of timber, and thirty-three have been instructed for one-fifth of one term in the study of the natural orders of plants.

During the whole year, with this large number of students, I am unable to recall a single act of discourtesy from any student in the class room or out of it. This indicates a continued interest in the work. During some portions of the year I have given a good deal of attention to two resident graduates who have been studying physiological botany. A large number of students have received assistance in preparing topics for the Natural History Society.

The botanic garden has been kept in very fair condition, considering the frequent change of students, who do all the work in taking care of the plants. The arboretum has received a few additions. It has been well cultivated and the trees have made a fine growth. The herbarium has received a good deal of attention and much hard work which is entirely out of sight of most people. The museum has been considerably increased; two large cases and one small one have been constructed and many specimens rearranged. No one who has never tried it can begin to understand the large amount of work required to collect, prepare, label and keep in good order a botanical museum. But very few colleges have much of anything in this line in their museums. The lower or main room is now nearly full, and next year I hope to have means to begin to fill the gallery.

I have nearly prepared for publication in my report a local Flora. Professor Bailey has also given the plants of this neighborhood a good deal of study. Such a Flora would be of much aid to our students who study botany, and would be welcomed by all botanists of the country. As time advances, and many of the plants of the neighborhood have disappeared through the invading hand of improvement, a good catalogue would increase in value. By ditching and clearing many native plants change their habits, some are exterminated, and weeds from foreign countries take their places.

THE FORESTRY COMMISSION.

Considerable time has been devoted to the study of the forests of Michigan during the year past. The continued ill-health of Hon. C. W. Garfield, the other director of the commission, has made it impossible for him to render the assistance that both of us had anticipated. The work of this commission has been very pleasant and no doubt very profitable, but it has taken time which I had hoped to give to the study of other subjects. I need not tell you that the position assigned to me in this commission was neither sought nor desired. For a further account of the work done in connection with the forestry commission, I refer to my report on that subject.

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THE EXPERIMENT STATION.

During the last half of the fiscal year I have devoted considerable time to making experiments and in preparing for others. I need not even mention to you, but will state the fact here that others who read this report may understand, that a full account of my work in the Experiment Station is given in another part of this volume.

FARMERS' INSTITUTES.

I attended and took part in the Forestry Convention, the institutes at Harrisville, Holt, Aurelius and Bunkerhill. The time needed on the forestry commission and the preparation of some part of volume second of my work on grasses compelled me to decline many invitations to lecture, including one by the Horticultural Society of New Jersey and another by the State Board of Agriculture of Wisconsin, for a third time to address them.

DONATIONS.

From Alpena Sulphite Fibre Company, Alpena, Mich.:
Samples of wood pulp in various stages of manufacture.
From Experiment Station, New Haven, Conn.:
A package of Anthoxanthum odoratum, variety puelii.
From O. C. McLouth, Addison, Mich.:
Package of Dipsacus sylvestris and Cuicus muticus.
From B. E. Ballard, North Lansing, Mich.:
A Marblehead squash.
From E. E. West, North Lansing, Mich.:
Four ears of yellow dent corn.
From Thomas Dearden, student:
A bunch of hickory knots caused by a fungus.
From Henry Beyer, New London, Iowa:
Twenty-four packages of various seeds from Holland.
From J. G. Gunnison, North Lansing, Mich.:
Samples of long walnuts.
From Mr. Huffman, Lodi, San Joaquin County, California:
Several specimen packages of almonds, wheat, barley, Japanese persimmons, pomegranates, palm leaves, olives, Egyptian corn, chestnuts, walnuts, corn, and potatoes.
From Dr. J. B. Steere, Ann Arbor, Mich.:
A box of various kinds of South American fruits, nuts, woods, etc.
From Gebhardt & Estabrook, East Saginaw, Mich.:
Fine samples of planks of white pine, Norway pine, and a wide pine board.
From J. H. Lawrence, Erwin, Dakota:
A pair of slippers made of grass and a grass twist used for fuel.
From Prof. C. C. Georgeson, Tokio, Japan:
Several packages of seeds of Eulalia.
From B. P. Cowley, Harrisville, Mich.:
Three ears of red blaze flint corn.
From Mrs Jno. Taft, Harrisville, Mich.:
Four ears early Compton corn and one ear early yellow corn.

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From Geo. H. Blush, Harrisville, Mich.:
Three ears of white flint corn.
From W. C. Gray, Harrisville, Mich.:
One package of white Probster oats.
" " " white Russian (spring) wheat
" " " white Zealand oats.
" " " flaxseed.
" " " timothy seed.
" " " white-eyed marrowfat peas.
" " " mountain bush bean.
" " " Clawson wheat.
From J. Van Buskirk, Harrisville, Mich.:
One package of barley.
From S. J. Youngman. Lakeview, Mich.:
Woodpecker's hole in a black ash.
From Elk Rapids Iron Co., Elk Rapids, Mich.:
Ten quart bottles of various distilled products from wood
From Prof. J. L. Budd, Ames, Iowa:
Several Russian trees and cuttings for experiments.
From Eugene Davenport, Woodland, Mich.:
Maple syrups in various qualities.
From E. M. Raffee, Clyde, N. Y.:
A Niagara grape-vine.
From Salling, Hanson & Co., Grayling, Mich.:
Six photographs of Grayling and vicinity.
Hon. F. A. Wilson, Harrison, Mich.:
A piece of gum tree encircled by a vine from southern States.
From Berry Brothers, Detroit, Mich.:
Samples of woods finished in hard oil.
From G. L. Teller, '88:
Specimen of oleander wood.
From C. B. Waldron, '87:
Specimen of petrified cottonwood from Sun City, Kansas.
From L. G. Carpenter, Agricultural College:
A cane taken from a cactus core.
From Mr. Ingersoll, Fife Lake, Mich.:
Several 26-inch pine shingles.
From A. A. Crozier, Ames, Iowa:
Cypress "knee" obtained from Louisana.
From S. E. Burnham, Bay City, Mich.:
Piece of plank from a mollusk eaten boat in Gulf of Mexico.
From W. E. Bond, '89:
Pair of wooden shoes.
From B. W. Herring, Litchfield, Mich.:
A specimen of double headed rye.

I cannot close this brief annual report without a reference to the enthusiasm and the successful work of my assistant, Mr. E. R. Lake, nor can I forget to again express to you my unfeigned gratification at the hearty support you have uniformly given. I am your true friend,

W. J. BEAL,
Professor of Botany and Forestry.

June 30, 1888.

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DEPARTMENT OF MATHEMATICS AND ENGINEERING.

President Willits:

DEAR SIR,—I have the honor to submit the following report of the department of mathematics and engineering for the past year, also a report of the principal engineering constructions in my charge during that time.

Respectfully yours.

R. C. CARPENTER,
Professor.

AGRICULTURAL COLLEGE,
June 30, 1888.

CLASSES MATHEMATICS AND ENGINEERING.

The principal work of this department is in connection with the teaching, but from the fact that the studies are fully described in the catalogue, it does not seem necessary to take much space in this report.

I taught in the fall term 1887, trigonometry and agricultural engineering, being on the average about 3 hours' teaching per day.

My assistant, Prof. L. G. Carpenter, taught sophomore algebra and calculus four hours per day.

Mr. J. B. Cotton taught freshman algebra three hours per day.

In the spring term, I taught civil engineering and trigonometry; this, including afternoon work, required four hours per day. Prof. L. G. Carpenter taught surveying which, with afternoon work, was four hours per day. Mr. J. B. Cotton taught freshman geometry three hours per day.

In the summer time I taught analytical geometry and strength of materials; this, with afternoon work, required five hours per day. Prof. L. G. Carpenter taught astronomy and Mr. Cotton taught geometry three hours.

Prof. L. G. Carpenter has been my assistant for the past eight years, and has been uniformly successful as a teacher. He will leave us at the end of this year for a higher position at the State Agricultural College Fort Collins, Colorado. Mr. J. B. Cotton has taught freshmen mathematics for the past two years and has proved a brilliant and capable teacher. He will leave us at the end of this year to take up the practice of law at Duluth, Minnesota. Both of these teachers carry with them the well wishes of all their associates and our students.

The testing machine, added by purchase last spring, has proved of great value in the teaching of the strength of materials. The students of the class made a series of tests of both metals and woods by tension compression and transverse strains. The Aluminum Co. of Findlay, Ohio, kindly furnished samples of aluminum bronze to be compared with common bronze. The machine has a capacity of 50,000 pounds. The department also has a steam engine indicator, made by the Crosby Steam Gauge Co.; also a planimeter and a set of accurate thermometers for testing properties of steam. These have already been of essential service, and will be more and more valuable each year.

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During the College year there is little opportunity for study or research, since the College duties require one's entire time. In order to keep abreast with engineering science, as well as to become acquainted with the work of a different school, I have spent such time as I could spare during the last two winter vacations in study at Cornell University, Ithaca, New York. I took advantage of the excellent equipment of that institution for experimental study, in investigating some problems relating to steam engineering, strength of materials and electrical engineering. I made, in connection with a student of Cornell University, Mr. G. B. Preston, an extensive series of experiments to determine the law of the internal friction of the steam engine and its distribution. These experiments were applied to engines of widely different types, and have been spoken of with much favor by Dr. R. H. Thurston, of Cornell. Principally because of this investigation, the degree of Master of Mechanical Engineering was conferred on me by the authorities of Cornell University.

In addition to my class duties, I have had charge of the steam heating works and various constructions, a few of which are described in the following pages.

ADDITION TO MECHANICAL BUILDING.

I prepared plans for the addition to the building in the summer of 1887. These plans were formally adopted by the State Board of Agriculture, and Secretary Reynolds and myself were authorized to contract for its erection. I was appointed superintendent of the construction. This addition consisted of a part 50x60 feet, one and one-half stories in height; the second story consisted of a gallery 15 feet wide extending around the building, and was designed for bench work in wood. The lower story consisted of a room 40x35, designed for lathes and machine tools in wood, a testing room 15x50 feet, an engine room 15x16 feet, also convenient store rooms and wash rooms for each shop. An addition one story in height, with clear-story for light and air, 30x32 feet, was built for the blacksmith shop. The contract price for erection was $3,000, but this did not include the heating, the inside window and door casings and some of the partitions.

The part not included in the contract was added during the winter vacation by Mr. H. Campbell, college carpenter, and Messrs. Wiseman and Hiscock, engineers, at a total cost of about $450.

The shops as they now stand, including machine shop, wood shop, blacksmith shop and testing room, are as commodious and convenient as any school shops in existence. With the addition of a small building as a foundry the shops will perhaps also be complete, and will have sufficient capacity for all the students likely to take the mechanical course.

With the recitation rooms in the north end of the building the case is entirely different. I need very urgently the present drawing room as a recitation room, while there is also great need for two rooms at least for the drawing classes.

Prof. Durand relieved me from the oversight of the shops the first of last September, and has in my opinion conducted the shops efficiently and well.

ADDITION TO WATER WORKS.

The estimate to the Legislature for water works was $3,000, as given by the State Board of Agriculture. In this I included the purchase of hose and

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hose carts, the extension of the water pipes to the President's house and the erection of water pipes with fire plugs in our large buildings. This estimate was reduced to $2,000 by the legislative committee, and that amount appropriated. By doing the work with our own help we were able to secure water service cheaper than estimated.

We have laid all the main water pipe required with nearly a sufficient number of hydrants, and put in service pipes to all the buildings. We have not however extended the water service for fire inside our principal buildings, neither have we sufficiency of hose, axes, or ladders for fire purposes. Our pumps and water pipes are however of sufficient capacity for any fire that is likely to occur. During our first vacation of the present year, a practical test of the efficiency of our water-works was made possible by a

FIRE IN WILLIAMS HALL.

This fire caught from a fumigating substance on the first floor, southwest corner of the building. When discovered, it had made considerable headway, the flames bursting from the windows, extended to the third floor on the outside of the building. Mr. Wiseman, the engineer, and Mr. Campbell, the carpenter, were the first to arrive at the fire, and immediately connected two lines of hose and got them playing on the fire. Messrs. Hiscock and Edgerly took charge of the pumps and got them working as soon as possible. The first pressure available was that from the tank or stand pipe and was only about 40 pounds. As soon as I arrived at the fire and saw that the pumps were working I connected them so as to pump directly to the hose, thus increasing the pressure to over 100 pounds. This pressure was sufficient to tear off lath and plastering, and to break out glass. In a short time we were able to get control of the fire. The damages done, exclusive of the furniture, was about $600. The Lansing Fire Department responded to our call for help, but did not reach us soon enough to be of any service. It was universally admitted that had it not have been for our own fire department, Williams hall would have burned to the ground.

The fire broke out in a fortunate position for our limited fire apparatus. We had no fire ladders; this fire started on the first floor and the need of them was not seriously felt, as the fire did not reach the third floor. We had only 400 feet of hose; this fire was within 100 feet of a fire hydrant. We had only two hose pipes or nozzles; this fire covered such a limited area that they were sufficient. Had the same fire started in the northeast or northwest corner of the same building, our want of hose and nozzles might have been a serious affair. The supply of water furnished by the pumps was entirely sufficient.

The extension of the water-works constructed in 1887, consisted of a line of six inch pipe, extending from the old pipe line west of College hall, to a hydrant east of house occupied by Prof. Cook, also a six inch branch from this line extending to a hydrant east of the house occupied by Prof. Johnson. From the hydrant east of Prof. Cook's house a four inch line was extended to the hydrant east of the President's house, and from the hydrant near Prof. Johnson's house, a four inch line was extended to the apartment house. Also a four inch branch was taken off nearly opposite Prof. Beal's house and extended to the new dormitory (Abbot's hall). Abbot's hall was not located until the system of water-works was nearly completed, and for

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that reason, the branch to it comes from the northeast, and was originally intended for Prof. Beal's house alone. Five hydrants of the Gaskill type were set on this line; one more will be needed at Abbot's hall.

In laying out our system of water-works I have been careful to have no length of four inch pipe leading to a fire hydrant longer than four hundred feet; wherever there is more than one hydrant a six inch pipe is used. It is believed that all of our hydrants will furnish water for two full fire streams.

We have also provided a hose attachment and fire plug in the southeast part of Wells hall.

THE ARTESIAN WELL,

which was fully described in the report for last year, has given us an ample supply of water for all ordinary purposes. Except for the fire in Williams hall, no water has been pumped from the river. This water is very hard and leaves somewhat more scale on our boilers than river water, but so far no injurious tendency has been exhibited.

STEAM HEATING APPARATUS.

The steam heating apparatus remains substantially the same as described in our last reports. Some changes have been made in Williams hall to increase its efficiency, and additions of small moment have been made in various places, among which I may mention the Olympic Society room and the addition to the Mechanical building.

We have added two boilers to our plant, each 5 feet diameter by 12 feet long. These boilers are built of steel, in accordance with plans and specifications prepared by myself. The contract for the boilers complete and in place was taken by the Lansing Iron and Engine Works for $1,850. We afterward relieved them of the work of setting the boilers and deducted their estimate for that item from the contract price. The boilers were set in accordance with the plans by Mr. Wiseman and Mr. Hiscock during our winter vacation. These boilers are set in accordance with my notion of a perfect boiler furnace, and I confess I am very proud of them. The boilers have proved very efficient and during the past spring term there has been no lack of steam. For a large portion of the term we had to maintain steam in the halls night and day, because of sickness among the students; this made a large increased expenditure for fuel and help.

My help for steam heating is the same as last year, viz., Mr. Wiseman, who takes a general oversight of the work, Mr. Hiscock, engineer and steam fitter, and Mr. James Edgerly, fireman.

HEATING ABBOT'S HALL.

I recommended a system of hot water heating for this building, because it was so distant from our general boiler house that the cost of conveying steam would probably be in excess of the cost of hot water plant, while a steam boiler in the building would be a source of constant danger and annoyance.

There were several bids for this work, and the job was let to the lowest bidder, Mr. F. C. Bennett, of Lansing. His work is to be done under my superintendence, in accordance with the plans and specifications prepared by the Detroit Heating and Lighting Co., of Detroit, Mich. They take the

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entire responsibility for the work and give a bond guaranteeing it in every respect.

The Bolton heater is to be used and the plans and specifications are prepared with care and by experienced men.

SEWER TO WILLIAMS HALL.

At the request of President Willits, I constructed a new sewer for a distance of 400 feet south of Williams hall. The upper portion of the old sewer was very old and so poorly laid as to make continual trouble from sewer gas and by clogging. The lower portion of the same sewer was in good condition.

The pipe used was a six inch pipe, and near the upper end four man holes were located, each 50 feet apart, which make the sewer accessible, and probably will provide means for cleansing. It had been my original plan to introduce a self operating flushing device, but it was impossible to secure depth at the upper end sufficient to insure the working of such a device.

DRAINS AND DRAINAGE.

The drainage for the triangular field north of the Lansing road, to be used for experimenting in grasses was laid out by this department, the work of construction has been, however, in charge of Mr. E. Davenport.

A few drains have been laid out for the farm department.

I have been making an experiment to determine the amount of heat lost by evaporation from undrained areas, as compared with drained areas. This experiment is not yet completed.

I read papers on the above subjects at Farmers' Institutes held at Owosso, Ithaca and Casspolis, also at the Michigan State Drainage Association. These papers were published in the periodicals devoted to drainage, viz: Drainage Journal, Potters' Gazette, and the Farmers' Club.

REPORT OF THE PROFESSOR OF ENGLISH LANGUAGE AND LITERATURE.

To the President of the College:

SIR,—The following is a summary of my work for the past year:

Fall Term.—Fifty-three agricultural freshmen, reciting every day, the class in two sections, were taken over the first half of Swinton's *General History*. Much time was spent in instructing them how to use dictionaries, maps, and works of reference, and every recitation was made an exercise in the use of English. Five students failed to pass the final examination. Sixty sophomores met me weekly in two sections for declamations and a study of *Evangeline*, which was reproduced as a prose narrative. Each student presented two declamations, and the reproduction, in an essay of twelve pages. The correcting of these manuscripts, about 700 pages, was done largely by Mr. Cotton. The juniors met with me weekly for the study of Shakespere, the play chosen being *As You Like It*. This study was

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preceded by two lectures, one on *Shakespere*, and one on *The Drama as a Form of Literature;* this class numbered about sixty. I met the seniors once a week for literary work, first reading *Hamlet*, this occupying five weeks; then listening to, and criticising their essays on authors and masterpieces, the manuscript afterwards being corrected, and criticisms explained. This class numbered thirty-three, each student presenting two exercises. I had charge of the public speeches of both seniors and juniors. Eighty-seven appointments were made, one for each morning at prayers, after the first two weeks of the term, and the remaining ones for Wednesday afternoons. A gratifying fact is, eighty-five speeches were presented at the appointed time.

As my assistant was not living at the College, it was necessary for me to spend some time looking after irregular freshmen in grammar and elocution. I had also in a general way to look after a class in elementary grammar, taught by Mr. Cotton the first two months of the term.

Spring Term.—By a change in the course of study, logic has been transferred from the elective studies of the senior year to the required course of the junior year, replacing the first hour of analytical chemistry. This subject was, by an understanding had when the change was made, temporarily assigned to myself. The text-book used was Jevon's *Elements*. The whole book was traversed, and much time given to illustrative examples in both the inductive and deductive methods. While the work was entered on with many misgivings, I am free to say, I never had more enthusiastic students, nora more profitable term's work for myself. The class numbered forty, and in addition to this work, had with me Shakespere every Thursday, reading *Merchant of Venice*, and their public speeches at prayers. I met the sophomores in two sections, weekly, for a study of Burke's *Speech on American Taxation*, an exercise supplementing the class work in rhetoric. The outlines of their argumentative essays were also brought me for criticism and suggestion. The freshmen, in two sections, each meeting twice a week, carried forward their work in elocution under my instruction. Each member of the class procured Webster's *Bunker Hill Oration* and the *Jefferson and Adams Eulogy*. Passages were assigned for the whole class to commit and declaim, as a basis for gesture, as well an exercise in quality of tone, force, time, pitch, and cadence; and paragraphs were assigned for individual declamation, the class having the text, while each exercise was presented. In this way all faults of pronunciation and enunciation could be easily noted; and almost the entire class, at the end of the term, had in memory two masterpieces of literature. The class numbered a few more than one hundred, each student presenting two exercises.

Summer Term.—Twenty-one seniors elected English Literature. The texts read were Burke's *Speech on Conciliation*, Shakespere's *King Lear*, Milton's *Samson Agonistes*, Browning's *Blot in the 'Scutcheon* and *Columbe's Birthday*, Tennyson's *Princess* and George Eliot's *Silas Marner*. One week was given to each selection. No time was spent reading texts in the class room; but a general informal discussion was had, in which it was the purpose to develop the merits of the piece, and determine whether each student had made a correct interpretation, and was appreciating the work. The entire class, thirty-three, met Wednesdays for the reading of *Paradise Lost*, of which four books were thoroughly canvassed. The seniors, not chosen for commencement orators, presented this term their final public speeches at the morning chapel exercises. The junior class, numbering forty, were con-

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ducted in the same manner as the class last year over their English Literature. Stopford Brooke's *Primer* was used as a basis for the historical work, with J. W. Hales's *Longer English Poems*, and Swinton's *Forty Masterpieces* furnishing texts for illustrative study and critical essays. This class continued the weekly reading in Shakespere with *Macbeth*. The commencement and class day exercises, at the end of this term, were, as usual, under my direction. During the year, in addition to the regular Wednesday afternoon lecture on *Browning*, and the State Institute work at Cassopolis, Adrian and Tecumseh, I have lectured at Benton Harbor, Brooklyn, Three Oaks and Port Huron.

In closing I have to thank you, and the State Board of Agriculture, for additional help, by which I am relieved from the burden of elocution, and the rhetorical exercises of the two lower classes, and given time for more adequate preparation in the more advanced work.

Respectfully submitted.

E. J. MACEWAN,
Professor of English Language and Literature.

AGRICULTURAL COLLEGE,
Sept. 1, 1888.

REPORT OF THE ASSISTANT PROFESSOR OF ENGLISH LANGUAGE AND LITERATURE.

To the President of the College:

I have the honor to report as follows, concerning my share of the work in English for the year 1887–88.

FALL TERM—GRAMMAR AMD ELOCUTION.

As last year, the fall term was devoted to the study of *Whitney's Essentials of English Grammar*. Much care was taken to make the study disciplinary and to make stronger thinkers of the pupils taking it. Close attention in class was given to forms of expression and correct spelling, all written exercises were required to be tidy in appearance and properly arranged. To aid us in expressing the analysis of sentences, Reed and Kellogg's system of diagraming was used with good results.

The class in grammar numbered 85, divided into three sections. Each section recited daily for three months. These students were also before me semi-weekly during the term in elocution drills and voice culture. Each one was required to recite two selections from English masterpieces. Our aim was to train pupils to assume easy positions on the stage, and to speak pleasantly and clearly. A very satisfactory drill was also given in extempore speaking. Each pupil was required to step to the platform and take his position for speaking before a subject was given him. He was then obliged to begin at once a three-minute speech on the subject given.

This was a very popular drill with the students.

SPRING TERM—RHETORIC AND ELOCUTION.

During this term the sophomore class came under my charge in rhetoric, the text book used being A. S. Hill's *Principles of Rhetoric*. The pupils

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were led to apply the principles laid down, and by constant practice acquire a clear and easy style of expression. Much stress was laid upon the necessity of reading good literature, and thus acquiring a good style. The class was pretty thoroughly drilled on the pronunciation of 100 commonly mispronounced words, and upon the authors and productions referred to in the text. Each pupil was required to write two six-page essays, one descriptive and one narrative, and to prepare an outline for an argumentative speech.

There were 83 students in the class, divided into three sections. There were more than 3,000 pages of manuscript prepared and handed in by this class.

The freshmen also met me semi-weekly during this term for elocution and voice culture. Each one gave two declamations; more attention being given to gesturing than in the preceding term.

SUMMER TERM—ELEMENTARY RHETORIC.

The freshman class of this term pursue the study of rhetoric with D. J. Hill's *Elements of Rhetoric* as a text book. A thorough drill on the fundamental principles of rhetoric marked the term. Each recitation was made a practical drill in expression. Spelling, pronunciation, and proper articulation were made special objects of study, and the principles laid down in the text were continually enforced by practice. In written reviews the pupil was required to shape his work neatly and in order. Slovenly work was not accepted. Each pupil wrote three essays: (1) A description of one of the College buildings, (2) a subjective description on a subject selected by the pupil, and (3) a narrative—a reproduction of the "Ride of John Gilpin." Each essay was carefully corrected by me, and the corrections read to the whole section. Much stress was also laid on the subject of properly outlining a production and also of paragraphing.

There were 52 students in the class, divided into three sections.

The work of the year has been pleasant, and I trust profitable. No time has been wasted in unnecessaries, and I cannot close this report without expressing my pleasure at the enthusiastic earnestness of the pupils whom I have met during the year.

Respectfully,

H. R. PATTENGILL,
Assistant Professor of English Language and Literature.

AGRICULTURAL COLLEGE,
August 12, 1888.

REPORT OF THE VETERINARY DEPARTMENT.

To the President of the Michigan Agricultural College:

SIR,—Permit me to submit the following report of the work done in the Veterinary Department of this College during the year 1887-8:

The fall term of 1887, being the beginning of the College year, was devoted to instruction in the anatomy of such domestic animals as the horse, ox, sheep and hog. The work was conducted from day to day by giving

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lectures in the class-room. These were illustrated with skeletons, models and diagrams, of which I spoke in my last report.

During the latter part of this term, two horses were purchased for dissection, and these were dissected by the students themselves. This part of the work is new, as far as being required is concerned, but the entire class worked at the subjects with much vigor, and when they were finished certain parts of them were selected by the students and drawings made from the original subject, each student drawing four plates of different parts of the body, thus getting a more thorough impression of the anatomy of the various parts; and here I wish to say that I think the drawings made reflected great credit upon the class.

The spring term, as in former years, was devoted to lectures upon the diseases of those parts, the anatomy of which we had been studying in the fall, and one day in the week was set apart for the discussion of certain drugs used in the treatment of disease.

The summer term could scarcely be looked upon as anything but a continuation of the spring term. I may add that the lectures during the spring and summer terms were illustrated, when it was possible to do so, by actual specimens of the disease in question, and samples of the drugs used were continually before the class.

THE MUSEUM

has continued to grow receiving, during the year, some very valuable specimens in the shape of fractured bones, in which complete union had taken place, and also diseased bones of various descriptions, as well as other diseased tissues, which added materially to the equipment for illustration, and thus enabled me to show the changes which had taken place between health and disease in a manner that could not be done without them.

Besides my regular class work I delivered my Wednesday afternoon lecture in the chapel, and issued two bulletins which appear in this report.

As State Veterinarian I have visited many parts of the State to investigate and report upon certain diseases, and have attended to considerable correspondence in connection with that office. I delivered addresses at four of our Farmers' Institutes and also addressed the Holstein Breeders' Association and the Dubois Lecture Association on matters pertaining to live stock.

During the winter I visited Wisconsin and delivered a course of lectures before farmers of that State at Institutes held under the auspices of the University, and while there addressed the State Dairymen's Convention at Ripon.

As a veterinary surgeon I have attended to the ailments of the live stock in the Agricultural and Horticultural departments of this College when requested to do so.

As veterinarian to the Michigan Experiment Station I have conducted experiments for it.

I have the honor to be, sir,
Yours obediently,
E. A. A. GRANGE,
Professor of Veterinary Science.

AGRICULTURAL COLLEGE,
June 30, 1888.

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REPORT OF THE MECHANICAL DEPARTMENT.

MICHIGAN AGRICULTURAL COLLEGE,
June 30, 1888.

To the President:

SIR,—I have the honor to submit the following report of operations in the Mechanical Department of this Institution since my connection therewith.

I reported to you for duty the first of last August, though I did not begin class-room work until the opening of the Autumn term.

During that term I taught the Mechanical Sophomore, and Agricultural Junior Mechanics, one-half term each; the French, and the Junior Mechanical Drawing.

In the Spring term I took the Mechanical Freshmen and Sophomore Physics, and the Sophomore and Junior Mechanical Drawing.

During the present term I am teaching the Junior Analytical Mechanics, the Freshmen Physics, and the Senior Thermodynamics and Machine Design.

Mr. P. B. Woodworth has charge this term of the Sophomore Agricultural Mechanics.

Mr. Holdsworth, in addition to his Free-Hand Drawing, has had classes in Mechanical Drawing as follows:

Autumn Term—Sophomore Mechanicals.

Spring Term—Freshmen Mechanicals.

Summer Term—Freshmen, Sophomore and Junior Mechanicals.

Mr. Holdsworth's assistance has been most valuable during the past year, and all classes have been duly attended to. With the full number of classes, however, I shall have, personally, time for little or no drawing, and Mr. Holdsworth will not have time to attend to both the Free-Hand and Mechanical Drawing, especially in the Spring term.

This seems to call for an increase in the teaching force in this direction, and if the classes are all to receive due attention, the assistance of a person capable of instructing in Mechanical Drawing and Elementary Mechanics seems almost a necessity.

This matter is so well understood by you that I have only to mention it here.

The class-room attendance throughout the year has been excellent, and the zeal and interest shown, highly commendable.

SHOPS.

In addition to class-room work, I have also had charge of the shops.

It has been here as elsewhere, a season of extension and busy prosperity.

The work has gone on smoothly and profitably.

Students in the wood-shop have been occupied in the routine work of making joints, model-framing, turning cups, vases, etc., and of pattern making.

In addition to these routine exercises, a number of articles for use in various departments of the Institution have been made.

Among these as more important, the following may be mentioned:

One hundred and six boxes for packing and shipping annual reports, 2 wood-boxes for chapel, 1 large rubbish box for Wells hall, 1 set free-hand drawing models (7 pieces), 5 laboratory tables for Veterinary Department, 1

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case of drawers for library index cards, 1 case for dried specimens for Horticulture Department, 1 case for apparatus for Botanical Department, 7 covers for steam pipe traps in grounds, 3 stands for Zoological Museum.

In the machine shop, work has been continued on the four lathes in hand at the beginning of the year. Three of them have been completed, and the fourth is well advanced. The castings for the 20 horse power engine, donated by the Lansing Iron and Engine Works, were duly received, and the engine will be completed during the present term. It gives every indication of smooth, successful working, and will prove a very valuable acquistion to our shop equipment.

Work on the engine and on the lathes mentioned above has occupied most of our time during the past year, though a large number of smaller jobs has been done, a detailed list of which would hardly be of interest here.

I submit, however, in connection with this report, an appendix showing in detail an estimate of the cash value of the work of the students during the past year. A record of each student's work in the shops is kept in detail. This record shows the number of hours spent by each student, and on just what pieces of work they are spent. Also the number of hours put upon any given job, may be readily determined from it. This record forms the basis of the appendix.

It must not be understood as by any means covering *all* the work of the students. In the wood shop particularly, a considerable portion of the time is spent on work purely for practice and the results, mostly joints of various kinds, model barn and roof framing, exercise in turning, etc., are not included in the estimates. It includes, as may be seen by examination, only such articles as have an intrinsic value; and the work in all cases was in answer to a definite need for such articles. It must furthermore be understood that the estimates given do not include the value of the material employed. They represent the additional value given to the material by the work put upon it.

A universal milling machine has been added to the equipment which greatly increases our capacity for building shop tools. It will be the policy of the Department to build as far as possible, all tools needed for our further equipment. This will give the students a wide range of work, while the articles not being intended for sale, there will be no temptation to develop specialists in order to get the greatest amount of work out of a given number of workers.

A considerable amount of physical apparatus has been added to the equipment during the year, and it should be our policy to add still further both by purchase and from the resources of our shops. Many valuable additions may be made in this way. There has been already constructed apparatus for exhibiting the wave motion in sound and light, a gyroscope, and whirling apparatus for the combination of color discs, besides a considerable number of minor attachments and auxiliary pieces.

In this connection mention may be made of three microtomes, which have been made at Dr. Beal's request, for the cutting of microscopical sections in connection with the study of botany.

The students in the blacksmith shop have been employed on the fundamental operations of forging, welding, tempering, etc., and keep the machine shop supplied with lathe and planer tools, and such plain forgings as are needed.

During last autumn term the sophomore agricultural students worked in the machine and blacksmith shops in eight sections, each section having about ten working days. Their work was very creditable.

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The agricultural freshmen also worked in the wood shop during the first half of the spring term, thus providing them with useful employment at a time when there was little to be done upon the farm or in the garden.

The work in the shop as a whole for the year has been very gratifying. A wide range in both wood and metal work has been traversed by the students, and many valuable and useful additions have been added to our permanent equipment.

ENLARGEMENT OF THE SHOPS.

During the winter the shop was enlarged by the addition on the south of an extension, 50x60 and of a blacksmith shop on the east, 30x30.

The extension on the south has been devoted to wood work, and has the testing laboratory on the first floor. The second floor of the older portion which was formerly used for wood work, has been vacated and will make room for light iron working machinery, as necessity arises for more space than the lower floor can furnish.

Conformable with the enlargment of the wood shop, the equipment has been increased by the purchase of twenty-five additional sets of carpenter tools, making a total of forty-two sets for hand work. This large outfit was rendered necessary for the accommodation of the agricultural freshmen who work in the wood shop during a portion of the spring term.

The equipment for the new blacksmith shop has also been completed, and provides tools and accommodations for eleven workers. The forges were constructed largely by the students, and for our purpose are in every way the equal of those for sale in the markets, the saving in cost being from ten to twenty dollars per forge.

I would, in this connection, strongly urge the employment of a blacksmith to give instruction in that line of work during the autumn term. The agricultural sophomores during that term will be taken in the blacksmith shop in four sections, numbering ten or twelve each, and in order that the work may be of the most benefit, the constant supervision of an instructor is necessary. This, with our present force, is impossible.

A considerable sum of money, originally intended for physical apparatus, was diverted toward equipment for the new shops, the latter object having been considered, for the time being, the more important of the two. The extension of our equipment of mechanical and physical apparatus should not, however, be allowed to suffer, and it may be hoped that appropriations in the near future will be made toward this end.

There are, furthermore, in addition to the tools and shop equipment which lie fairly within our capacity, many others very necessary, but made by special machinery and out of the range of our equipment. Of these the most important representation is a series of standard gauges and other measuring instruments. Liberal appropriations for such tools would add greatly to the attainable accuracy and precision of our work, and greatly increase its value to the student.

During the winter I attended the Cassopolis Institute, as appointed, and lectured on the relation of mechanics to agriculture.

In closing, I wish to thank you for the cordial support which has been extended to me since my entrance here on a new field of labor.

Very respectfully submitted.

W. F. DURAND,

Prof. of Mechanics and Supt. of Shops.

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Appendix showing cash value of work done in the Mechanical Shop during the past year.

No.	Description of Work.	For Mech'l Department.	For Other Departm'ts.
	Wood Shop:		
106	Annual report boxes		$20 00
2	Wood boxes @ 60c		1 20
1	Large rubbish box		1 00
1	Roller for screen in Mechanical Lecture Room	$1 00	
2	Bulletin Boards		2 00
7	Free-hand drawing models		6 00
2	Boxes for taps and dies	4 20	
1	Set shelves for finished work	4 70	
4	Guards for steam-heaters @ 25c		1 00
2	Step-ladders @ $1.40	2 80	
4	Laboratory tables for Veterinary Dept. @ $3.00		12 00
1	" " " " " @ $2.00		2 00
1	Case drawers for library index cards		15 00
1	Case for Horticultural Dept.		9 00
1	Bread-board		75
2	Flower boxes in Chapel @ 50c		1 00
7	Covers for steam pipe traps in ground @ $1.00		7 00
	Repairs and dressing up desk for Library		5 00
2	Stands for Zoological Museum @ $1.50		3 00
1	Folding-leg table for Greenhouse		3 00
25	Tool cases for Carpenter Shop @ $2.50	62 50	
1	Case for Botanical Dept.		9 00
1	Drawing board and stand	2 50	
	Outside repairs (odd jobs)		2 60
	Pegs for Armory		1 00
	Tools, repairs and extension in Mech'l Dept.	40 80	
	Patterns for shop use	8 60	
	Total for Wood Shop	$127 10	$101 55
	Iron Shop:		
	Apparatus, odds and ends	$4 60	
	Sound and light vibration apparatus	7 00	
	Gyroscope	8 00	
	Harmonic curve apparatus	6 00	
	Tools for shop use and extension	75 10	
	Fifteen inch engine lathe "D"	63 05	
	Twelve " " " "E"	53 70	
	" " " " "F"	54 15	

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Iron Shop.—Continued.

No.	Description of Work.	For Mech'l Department.	For Other Departm'ts.
	Wood lathe "B"	$19 25	
	" " "C"	19 70	
	Repairs to shop tools	4 60	
	Nuts for shop use (tapping, facing and finishing)	17 40	
	Surveying pins		$0 80
	Turning specimens for Testing Laboratory		4 80
	Three microtomes @ $20.00		60 00
	Three blacksmith forges @ $3.00	9 00	
	Four " " " $5.00	20 00	
	Twenty horse power engine	450 00	
	Total for Iron Shop	$811 55	$65 60
	Total for Wood Shop	127 10	101 55
	Total for both	$938 65	$167 15
	Sum total for both shops $1,105.80		

REPORT OF PROFESSOR OF MILITARY SCIENCE AND TACTICS FOR 1887–8.

To the President Michigan Agricultural College:

SIR,—I have the honor to submit the following report of the work done in the Military Department during the year of 1887–8, and of the condition of the Department at the present time.

Having been detailed by the war department as Professor of Military Science and Tactics at this college, with orders to report for duty on the 15th of December, 1887, I have no report to make of the work in the department for the fall term of the College year that has just closed.

Beginning my work at the College with the opening of the spring term of 1888, I found the Department in excellent condition. The members of the senior and junior classes, and many of the sophomores were quite proficient in their knowledge of infantry tactics so far as to include "company drill," and all except the new members of the freshmen class were well advanced in the drill.

Two companies were organized early in the term, and officered by increasing the number of cadet officers and non-commissioned officers then present, by promotions and appointments, and the department work for these companies was continued daily throughout the term in reviewing the preliminary

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instruction and setting-up exercises, and in company drill. The freshmen who entered in the spring, and such other students as had not before taken the drill, were trained in squads by competent drill masters selected from the officers and non-commissioned officers of the companies, under my direction and supervision, and many of these were sufficiently advanced in the drill to be assigned to the companies before the close of the term.

I found the interest taken by the students in the work of the department excellent, and the discipline easy to maintain. Few absences from drill were reported where illness or other legitimate excuse was not rendered.

The record for the term is as follows :

Number of cadets enrolled	141
Average attendance at drill	88

When it is remembered how many students were late in returning to the College in the spring term, and also that there were many cases of illness from mumps and measles during this term, the average is good.

According to the schedule in the catalogue, no drill was required of the students during the summer term. If the juniors and sophomores drilled at all it was to be in addition to the full three hours' work. The freshmen were allowed to elect between three hours' work per day or two hours' work per day and drill. During the hot summer months not many of the students would voluntarily, and in addition to what is considered full work, add an hour of military training. Upon a request from me, and the acquiescence of the Professors of Agriculture and Horticulture, whose plans in the work system the change would affect, the faculty kindly consented to allow the juniors and sophomores to elect an hour of drill two days in a week in lieu of an hour of work. This enabled me to retain a battalion of fifty-six cadets during the term and keep them fresh in military duties. With these the new year will start with a good basis upon which to build, and with plenty of well-drilled squad masters to help in training the new class. In twelve battalion drills the corps was advanced in the school of the battalion as far as is practicable for a battalion of two companies.

By special invitation, on June 13, the battalion gave an exhibition drill on the Capitol grounds in Lansing, before the Michigan Legislative Association in reunion, and participated in the procession and parade in Lansing on the 4th of July.

Upon an application to the State Board being approved, and the necessary funds provided, aparatus for gymnastic training has been provided and placed in the armory. With this, systematic training in calisthenics and gymnastics has been given to about sixty students during the past term. Some things are still to be added to this apparatus, and it will form a valuable adjunct to the means of physicial and military training. Most of the machines and devices have been constructed, and all have been put in place by student labor under my direction.

The Mechanical Department has rendered me much assistance, in providing the place and facilities for this work.

Some changes in the department work have been agreed upon by the faculty, and the new scheme is incorporated in the catalogue for 1887-8. I am gratified with the change, and confidently expect to obtain better results under the system that takes effect at the beginning of the coming College year, than could be reached by the system heretofore existing.

The voluntary element, so opposed to all principles of military discipline,

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has been eliminated, and the schedule is so arranged as to allow the entire corps to drill at the same hour.

RECOMMENDATIONS.

I heartily concur with my predecessor in his recommendation in regard to a change in the discipline of the College.

I would recommend that discipline should be given a value in the standing, and a student should be required to be proficient in discipline in order to graduate. All absences from required duties, unless the student be excused by competent authority, would then be looked after by those having charge of the discipline and would count against the standing of the student.

Students could be marked on the relative attentiveness to work, drill, and college rules generally; and there would be some distinction in standing between the student who is attentive, diligent, and obedient in all departments of work and study, and the student who may have barely avoided suspension or expulsion by neglecting drills, and shirking work on the garden or farm.

A system could easily be inaugurated of sending in reports for delinquencies to the Commandant of Cadets, who could have them posted and recorded. The students could be required to submit explanations to these reports, and such explanations as should be deemed unsatisfactory could be finally submitted to the President of the College. In his office could be recorded all such delinquencies as were not satisfactorily explained, and the number of demerits fixed for the delinquency entered.

This is but indicating very briefly the system I propose, but it would be readily developed, and would add much to the justness and fairness to students of the College.

I am, sir, very respectfully,
Your obedient servant,
WENDELL L. SIMPSON,
2d Lieut. 24th U. S. Infantry,
Professor of Military Science and Tactics.

AGRICULTURAL COLLEGE, LANSING, MICH.,
August, 1888.

REPORT OF THE LIBRARIAN.

The past year has been one of activity in the library. Students have more and more made use of the books and the best of order and good feeling has existed.

The subject cataloguing has been continued, Miss Ida L. Hooker having worked steadily during this school year, in addition to what work I have been able to do personally.

The accessions to the library have been 1,151 volumes this year. Of these three hundred and forty seven came by purchase, four hundred and seventeen by binding and the remainder by gift.

Bound volumes were given us by the following persons, viz:

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Beal, Dr. W. J.—Eight volumes of reports; forest commission, State of New York.

Burrill, Prof. T. J.—Illinois University Rept. 1886.

Crabb, M.—Miscellaneous reports, 14 Vols.

Canada,—Geological Survey, 3 Vols.

Colona, B. A.—Secular variation of magnetic declination.

Draper, Daniel,—N. Y. Meteorology, 1888.

France,—Album Statistique Agricole; Minister of Agriculture.

Goodell, H. H.—Miscellaneous Reports, 8.

Hale, P. H,—Live Stock Breeders' Directory.

Heron, Alex.—Indiana Agricultural Reports, 7.

Kedzie, Dr. R. C.—Seybert Commission on Spiritualism.

Lelong, B. M.—California horticulture, 1885–6.

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Hon. O. L. Spaulding and Hon. F. B. Stockbridge have kindly remembered us in their distribution of reports:

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Agriculture, 50 pamphlets on various subjects.
Agricultural Colleges and Experiment Stations, and Farm Stations—Wm. Saunders.
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Journal of Royal Agricultural Soc.
London Lancet.
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Fortnightly Review.
Garden.
Gardener's Chronicle.
Journal of Anatomy.
Journal of Chemical Society.
Scottish Review.
Spectator.
Veterinarian.
Veterinary Journal.
Westminster Review.

American—by Subscription.

Agricultural Science.
American Agriculturalist.
" Architect.
" Bee Journal.
" Chemical Journal.
" Cultivator.
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Boston Journal of Chemistry.
Botanical Gazette.
Breeders' Gazette.
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Critic.
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Detroit Tribune.
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Engineering Journal.
Farmers' Review.
Forum.
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Gardener's Monthly.
Harper's Monthly.
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Homestead.
Independent.
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Journal American Medical Association.
Journal Franklin Institute.
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" " Supplement.
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Shakspeariana.
Sidereal Messenger.
Southern Cultivator.
Torrey Bulletins.
Vick's Monthly.

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American—By Gift of Publishers or Individuals.

Allegan Gazette.
" Record.
Adrian Times.
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" Sheep Breeder.
" Swineherd.
Appleton's Literary Bulletin.
Arkansas City Traveller.
Bee Keeper's Magazine.
Buffalo Journal.
Canadian Horticulturist.
Charlevoix Journal.
Charlotte Republican.
Chicago Medical Times.
Christian Register.
City and Country.
Clinton Independent.
Coldwater Republican.
Dairy World.
Deaf Mute Mirror.
Farm and Fireside.
" Field and Stockman.
" Home.
Farmer's Advocate.
" Club Journal.
Flint Globe.
Fruitman's Guide.
Fruit Growers' Journal.
Genesee Spectator.
Good Health.
Grand Haven Herald.
Grand Traverse Herald.
Grange Bulletin.
" Visitor.
Hillsdale Leader.
" Standard.
Holstein Friesian Register.
Imports and Exports of U. S.
Industrialist.
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Ionia Sentinel.
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Lansing Journal.
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New England Farmer.
Official Gazette.
Practical Farmer.
Popular Gardening.
Roscommon News.
Sacramento Union.
Saginaw Morning Herald.
Sorghum Growers' Guide.
St. Louis Leader.
The Sun.
Three Rivers Tribune.
Traverse Bay Eagle.
Toledo News.
Union Signal.
Unitarian Review.
Village Echo.
Watchman.
Weekly Globe.
Western Resources.
" Agriculturist.
Wolverine Citizen.

The Experiment Station Library has been organized during the present summer, and many desirable works not owned by the regular library have been already found for this library.

It now has 340 volumes besides many reports presented by the main library. The books are plainly marked by a red card upon the back and they are placed in cases of their own. They are all roughly subject catalogued and ready for use.

This closes my fifth and last year in the library, during which time the

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library has made an increase of over 5,000 volumes; has acquired a title catalogue, and has come from no subject catalogue at all up to one of over 45,000 references; the library was open formerly fourteen hours a week; the past year it has been open sixty-six hours a week.

During all this time the students have been deserving of the highest praise, the work has been always a pleasure, and I bespeak for my successor the same cordial support which has been given me.

Respectfully submitted.

M. J. CARPENTER,
Librarian.

To President Edwin Willits.

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THE LUMBERMAN HAS TAKEN WHAT HE WANTED.

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REPORT

OF THE

INDEPENDENT FORESTRY COMMISSION

OF THE

STATE OF MICHIGAN

FROM

June 27, 1887, to June 30, 1888.

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THE LAW PROVIDING FOR A STATE FORESTRY COMMISSION.

Public Acts of Michigan, 1887.—Act No. 259.

AN ACT to provide for an Independent Forestry Commission of the State of Michigan and to define its duties and powers and to provide for the expense thereof.

SECTION 1. *The People of the State of Michigan enact,* That the members of the State Board of Agriculture are hereby constituted a commission to be known as an Independent Forestry Commission.

SEC. 2. It shall be the duty of said Forestry Commission to institute an inquiry into the extent to which the forests of Michigan are being destroyed by fires, used by wasteful cutting for consumption or for the purpose of clearing lands for tillage or pasturage. Also as to the effect of the diminution of the wooded surface of the land upon ponds, rivers and water power of the State, and in disturbing and deteriorating the natural conditions of the climate. Also as to the protection of denuded regions, stump and swamp lands.

SEC. 3. Said Commission shall make report of the results of their inquiries to the Governor of the State, together with such legislation as seems to them expedient to propose to preserve and restore the forest wealth of the State, sixty days before the assembling of the legislature for the year eighteen hundred and eighty-nine, and the State printer, under the direction of said Commission, shall cause to be printed as many copies of said report for distribution as they may deem expedient.

SEC. 4. It shall be the duty of the supervisor of each township, on or before the first Monday of June, eighteen hundred and eighty-eight, to make a careful estimate of the area and condition as to the stage of growth, density and character of forest land in their several towns. Also the area and waste of barren land on which valuable forest trees might be grown, and report the same to the Forestry Commission. A consolidated summary of these returns by counties, and of the information as to the same matter otherwise gathered by said Commission, shall be included in the annual report.

SEC. 5. The supervisor of every township as aforesaid and in which a forest fire of more than one acre in extent has occurred within a year, shall report to the Forestry Commission the extent of area burned over, to the best of his information, together with the probable amount of property destroyed, specifying the value of timber, as near as may be, and amount of cord-wood, logs, bark or other forest product; also fencing, bridges and buildings that have been burned. They shall also make inquiries and report as to the cause of these fires, if they can be ascertained, and as to the measures employed and found most effective in checking their progress. A summary of these returns by counties, and of the information otherwise gathered by said Commission, shall be included in their annual report. Blanks for the reports required in this act shall be furnished by tne Forestry Commission to the several townships at the expense of the State.

SEC. 6. The said Commission shall serve without compensation, but a sum not exceeding one thousand dollars is hereby appropriated to pay the necessary expenses incurred in collecting the information required by this act to be ascertained by said Commission, to be paid for by the State Treasurer, upon the warrant of the Auditor General, out of any funds not otherwise appropriated.

Approved June 27, 1887.

Under the provisions of the above law the members of the State Board of Agriculture, in response to a special call issued by Hon. Franklin Wells, senior member of the Board, met in the office of the Board, at the Capitol, in Lansing, on the 26th day of October, 1887, and effected a formal organization by the election of officers and a Board of Directors, to carry on the work of the Commission.

The members and organization of the Commission will be found on pages 4 and 7 of this volume.

HENRY G. REYNOLDS,
Secretary.

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PREFATORY NOTE.

Brevity has been sought in the following report to the exclusion of important matter germane to the work of the Commission. The proceedings of the Forestry Convention at Grand Rapids will be found later in this volume among the reports of Farmers' Institutes; and, also in this volume, in the report of the botanist of the Experiment Station there is a brief account of experiments in forestry begun on the Jack pine plains of the State, as well as an account of the organization of a party and their trip across the State in June, for the purpose of studying the forestry and agricultural possibilities of the region traversed.

This volume is really but a small beginning of the work that Michigan might do in connection with the investigation of this great forestry question as affecting the future of our State, and the formulation of such methods and laws as will render permanently valuable the results of investigation.

It is prepared by men whose time is occupied quite fully with other duties, and should not be compared with the more elaborate treatises issued by other states at large expense, and which contain the researches of experts employed for a long time on small divisions of the general subject.

From articles that have appeared in the public press, words that have been dropped in lectures and essays, and letters that have been written the Commission, the feeling has grown upon the directors that in some quarters there is gross misapprehension of their views with regard to timber planting and removal, and they take the liberty of stating in this connection that they are not opposed to the removal of timber; they do not recommend that farmers should go to planting forests on good arable land; they do not believe that peril is imminent to Michigan as a result of the extensive elision of the forests.

On the contrary, they commend the practice of securing the best possible returns by cutting off the mature timber of our State, and have no sentiment to waste over the removal of the monarchs of the forest that are ready for the harvest.

They do deprecate wasteful methods of cutting, and feel most earnestly the desirability in Southern Michigan of planting out waste land, odd corners upon farms and borders of streams to rapidly growing trees that can be cared for at minimum expense, and will grow into valuable timber largely while men are sleeping. They do believe most emphatically in teaching children and young people a respect for growing trees, developing in them a love for the planting and growing of trees, and opening to them a knowledge of the influences of trees and forests upon the people and the modification of civilization as affected by the deforestation of a country. They do feel earnestly the desirability of spreading among the people the most reliable information about tree planting, characteristics of the most desirable kinds to plant, economical management of farm woodlots and the advantages that will accrue to the horticulturists of our State as a result of correct knowledge as to the protective advantages of timber areas to the fruit growing interests of our State. And, lastly, they are not unmindful of the tendency, as a result of forest removal, to climatic conditions that characterize treeless regions to the west of us, which would in nowise be to our advantage.

WM. J. BEAL,
CHAS. W. GARFIELD,
Directors.

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FOREST MANAGEMENT IN SOUTHERN MICHIGAN.

[BY W. J. B.]

After traveling extensively in all the southern counties during the last eighteen years, I feel confident in saying that the area of land in forest is constantly diminishing. I know of no pieces of land of much extent where timber has been planted or where trees once cut are again allowed to sprout and grow.

In places where the area remains undiminished, the quality in nearly all cases is deteriorating on account of the common practice of removing many of the most valuable trees.

Again, it is a custom well-nigh universal among farmers, to pasture the wood-lot. By turning in the cattle, sheep, horses and swine, the seedlings are all destroyed, the young trees are often killed or their growth checked by the animals which take off a portion of the leaves. In some portions of the State farmers cut out the undergrowth from their reserved wood-lot to improve its appearance. When the undergrowth is removed by any process, and some of the larger trees cut down, light penetrates the forest, and with more light grasses find their way among the trees and a turf of greater or less firmness gives a park-like aspect to the reserve wood-lot. It looks very well for the present, but the grass checks the growth of the trees.

It needs no deep deliberation of a philosopher to see that the days of all wood-lots thus treated are numbered. Some may say that it is not worth while to try to retain any forest in the older portion of our State. That we can buy timber cheaper than we can raise it; still we feel sure that nearly every farm is managed with greater profit to the owner where more or less of it is kept in forest. Not enough attention is given to filling in open places with kinds of trees which will be most valuable to grow for future use. The trouble and expense is not so great as most suppose.

"A German farmer would as soon allow his cattle to range in his wheat fields as in his forests, which often prove the most profitable part of a European estate. In this country the wooded part of the farm is not cared for, nor protected in a way to maintain and increase its value. It is always used as a pasture, in spite of the well-known fact that cattle are fatal to a forest. The trees are either all cleared off at once, without reference to their protection, or are so carelessly selected for cutting, that the character and composition of the woods are ruined."—*Garden and Forest, Vol. 1, page 229.*

"In no branch of agriculture, perhaps, do the people of the United States so need instruction now as in all matters relating to the care and improvement of the woods and woodlands connected with farms. It is almost a universal custom with American farmers to neglect this part of their property, and to be satisfied if the wood lot furnishes a little pasturage to their stock and a scanty supply of half-rotten or worm-eaten wood for the kitchen stove."—*Garden and Forest, Vol. 1, p. 310.*

"The first requisite in forest life is to keep the ground fully shaded—so much so that grass cannot grow—to keep it moist and free from packing, or the tracking of cattle, and to encourage such a growth that drying winds may not enter."—*Canadian Horticulturist, quoted by Garden and Forest, Vol. 1, p. 310.*

FOREST FIRES.

[BY W. J. B.]

This subject, so important to the people living in the newer portions of our State, and in may other States, especially where there are many cone-bearing trees, is one which has perplexed large numbers of persons for a long time.

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Fig. 1

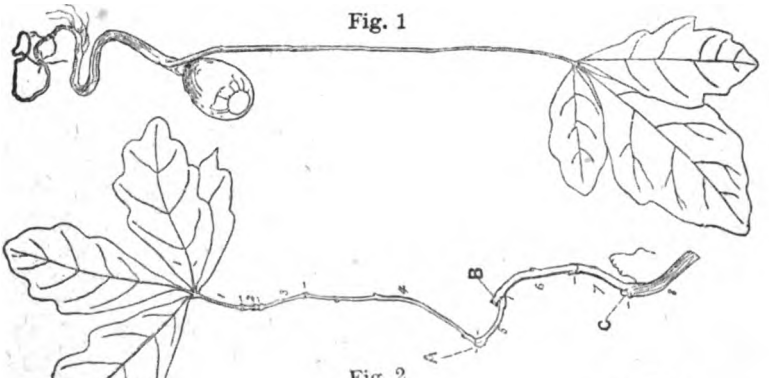

Fig. 2

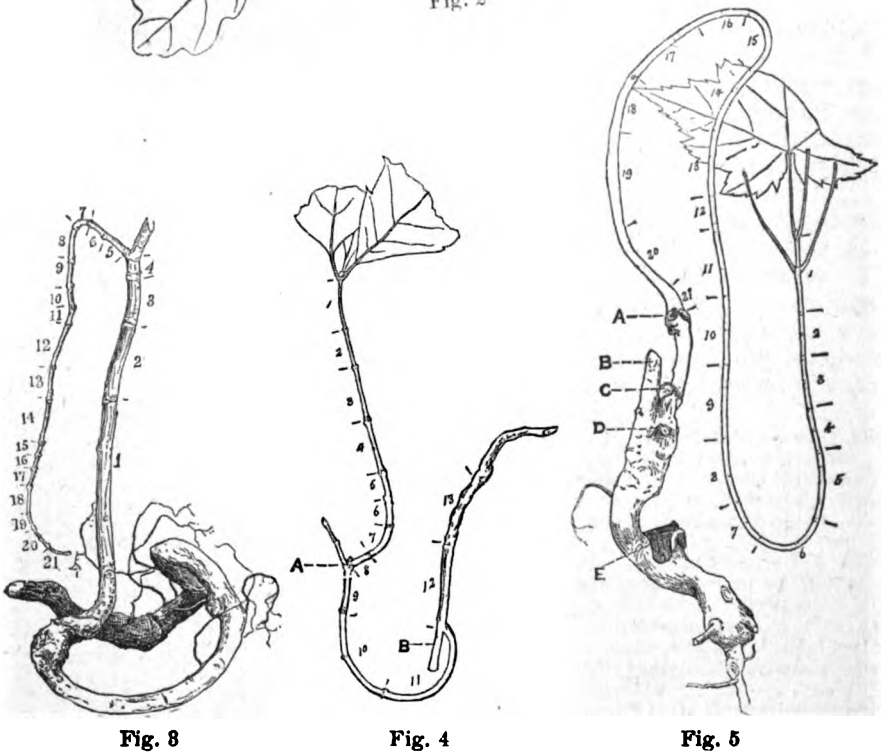

Fig. 3 Fig. 4 Fig. 5

Fig. 1.—A young white oak, two years old, from a dense forest: the "shell" of the acorn still attached.
Fig. 2.—White oak, at least eight years old, from dense forest.
Fig. 3.—White oak, at least twenty-one years old, from dense forest.
Fig. 4.—Black oak from dense forest: showing the age and dead branches.
Fig. 5.—Red maple from dense forest: the twig bent in drawing to save space; age, twenty-one years. See the scars, A, B, C, D, E, where former stems have died back.

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It was well discussed at our forest convention held last winter in Grand Rapids.

In the minds of the directors, it has from the time of establishing the State Forestry Commission to the present, seemed to be the one question demanding most careful consideration.

These fires continue to prevail in many places and accomplish great destruction. The sources of the fires are numerous and varied and some of them past finding out. They are sometimes started by careless berry-pickers, river-men, hunters, and often by the engines along the railways.

In a very dry time, on light soil, the dead pine leaves, when touched with a burning match, will spring into fire which will spread at an incredible speed.

If the air is still it moves more slowly and may stop when it comes to some well beaten road.

It is the custom in many places to burn rubbish in early spring where trees have been removed, that it may not be left to burn in a dry time and endanger neighboring forests, or any other property.

There is not often much danger from fires in thickly wooded regions, where there are few or no cone-bearing trees.

There is a great chance for some persons to do philanthropic work in changing the views of some of the settlers in regard to exercising greater care to prevent the starting of fires.

With the present views of the settlers, and their isolated positions it is next to impossible to preserve pine timber from fires without incurring too great an expense by way of guards and other means of insurance.

To save a good pine forest, as the country and the people are now constituted, is a very hazardous undertaking.

For example: Southeast of Harrison, in Clare county, parties own a pine tract of white and Norway pines and mixed deciduous tress, with some hemlock. Most of the surrounding pine has been cut and removed. That remaining, where none has been cut, is tall and thrifty, some of it under size. The most of it, if left, would improve for fifty or one hundred years. The proprietor would very much like to hold the forest for improvement and for better prices. The rubbish on the west was burned in spring; a man detailed near the forest all summer to prevent or subdue fires. July brings dry weather, and one day or night, the fire starts and spreads rapidly, feeding on dead leaves and a small amount of old logs and brush.

Nearly all the young growth is killed to the ground; the fire rages with such fury that it is almost impossible to do anything to allay it or to save the life of some of the best trees which are in danger. The owner has lost much by the fire and must change his plans. The dead timber must soon be cut to keep it from damage by insects and decay. The owner and the people of the neighborhood suspect that the forests were set on fire by some one for the purpose of killing the trees, so that laborers could find employment next winter. The owner offers a reward of five hundred dollars for the conviction of the guilty man, with scarcely any prospect of having to pay the reward. If he hold the living timber, he must clear roads through the forest and watch it at a high cost. He probably now prefers to pattern after most other proprietors of pine forests, viz., to cut and remove what remains as soon as possible, realizing all he can, rather than to run the great risk of holding it for improvement at a better price.

To give another illustration: Salling, Hanson & Company, last spring

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owned an isolated piece of 80 acres of nearly pure Norway pine forest, in Crawford county. The forest was quite destitute of any dead tops or other rubbish; the surrounding dead materials had been previously burned. On August 15, by some unknown measure, fire was started and spread with great rapidity. There was no use of making any attempt to stop such a quick, fierce fire. The damage was probably about ten thousand dollars. The proprietors say it is impossible to watch such lands to any purpose.

There is no denying the fact that a new country, where cutting logs, manufacturing lumber and shingles is the leading business, abounds in rough characters who do not hesitate to do most any mean thing when there seems to be any excuse for it.

Fires are seldom very troublesome in dense deciduous-leaved timber, especially where the land is loam or clay.

OBSERVATIONS ON THE SUCCESSION OF FORESTS IN NORTHERN MICHIGAN.

[BY W. J. B.]

It has often been observed by many persons that when a virgin forest is removed by cutting or killed by burning, or by both causes, that if left to itself, the succeeding growth differs in part at least from the original forest.

Various reasons, including many theories, have been given to account for this change, while there are a large number of people who do not pretend to understand the subject.

One teacher of science advanced the theory that acorns and hickory nuts and other nuts and seeds of trees retained their vitality in the soil for a hundred years or more, and when opportunity offered, they were ready to germinate and produce trees.

Another class of persons entertain the views contained in the following quotation:

"When one form of life has been destroyed, another takes its place. When, for instance, a forest of pines has been destroyed, anothor, not of pines, but of oak and chestnut, springs up in its room. It does not appear, as the result of a great number of observations, that by the so-called processes of nature, acorns and chestnuts were planted after the destruction of the pine tree, but rather that the germinal principle was in the ground, waiting for the proper conditions to develop it. A multitude of similar instances of the spontaneous growth of new vegetation, replacing that which has been burned or otherwise destroyed, are cited by observers."*

Some writers believe that certain kinds of trees exhaust the soil of certain substances, and that other trees follow which require different conditions.

But on investigation, we find that forests of the same sorts in some instances have held their own and have thrived for 1,000 years in succession; such as beech, fir, and spruce in Germany. Foliage, dead limbs and trunks enrich the land by returning a good share of the best materials to the soil.

"If we compare the amount of mineral substances which are severally removed by a field crop and a timber-growth, we find that a wheat crop abstracts from the same area five times as much inorganic basis as the beech, ten times as much as the pine, the turnip ten times the amount of the beech, and twenty-two times that of the pine.

*LIFE TEMPORAL AND ETERNAL, by Rev. Wm. R. Hart. Published by J. B. Lippincott & Co., 1882

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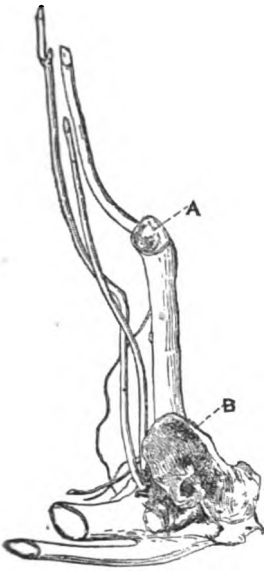

Fig. 6

Fig. 7

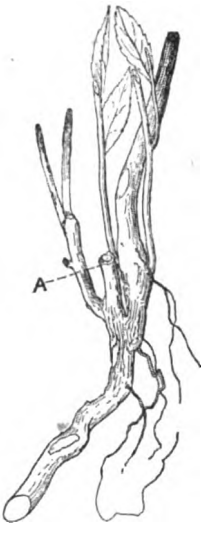

Fig. 8

Fig. 9

Fig. 10

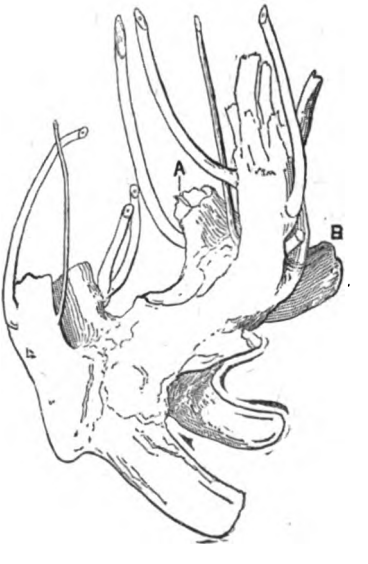

Fig. 11

Fig. 6—Witch hazel from dense forest; more than once burned over.
Fig. 7.—Low willow; several times killed back by fire; still alive.
Fig. 8.—Huckleberry from dense forest; killed by fire and putting up new growth.
Fig. 9.—Blackberry killed back by fire and beginning to send up sprouts.
Fig. 10—Sweet fern; formerly several times killed to the ground by fire; still living.
Fig. 11—Service berry, still growing, though on numerous occasions it was formerly set back by fire.

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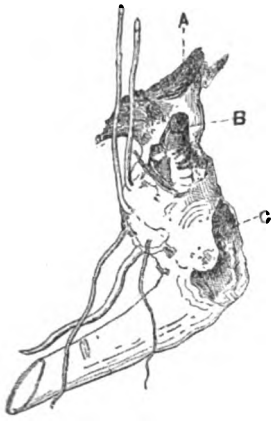

Fig. 12

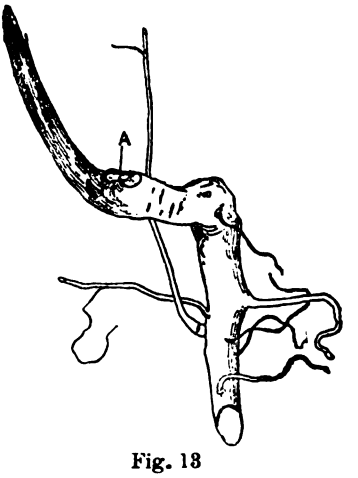

Fig. 13

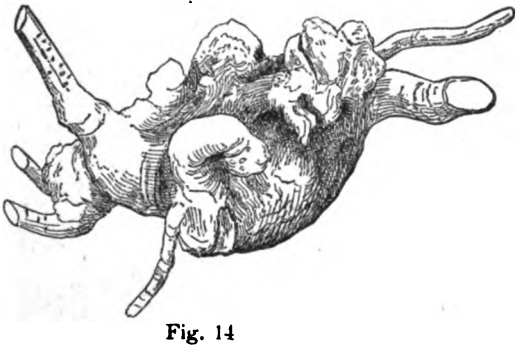

Fig. 14

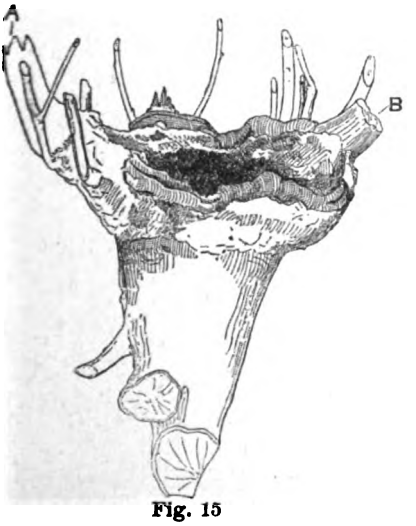

Fig. 15

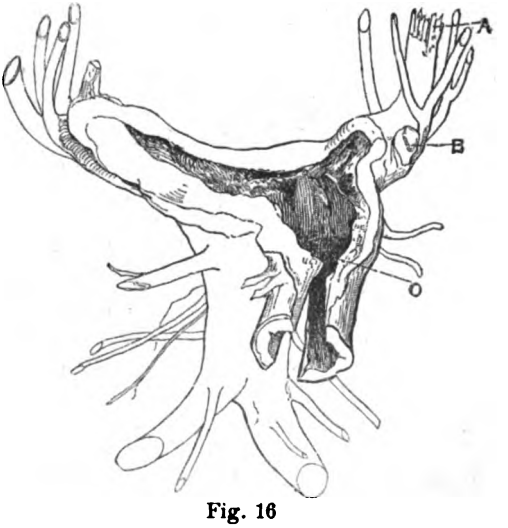

Fig. 16

Fig. 12.—Grub of white ash sprouting; stems had several times been killed by fire on former years.
Fig. 13.—Large-toothed aspen, sprouting from a stump.
Fig. 14.—Grub of black cherry still sending up sprouts. It had several times suffered by fire.
Fig. 15.—Grub of white oak many times killed back; dying at the middle, sprouting on the margin.
Fig. 16.—Grub of white oak, doubtless once like Fig. 15, now decayed in the middle, including its main root; sprouting on the margins, each time after it was killed to the ground.

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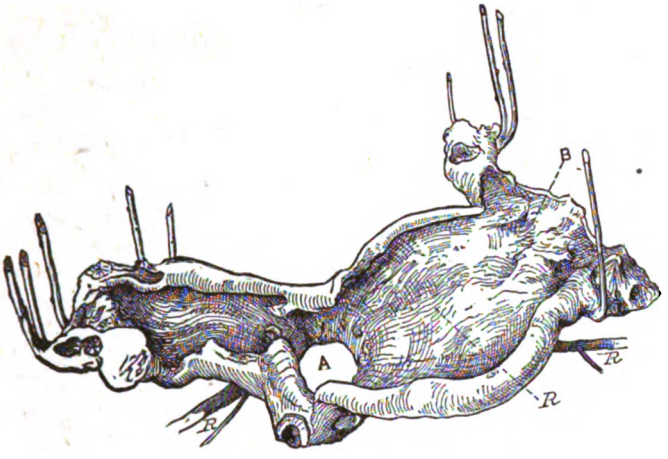

Fig. 17

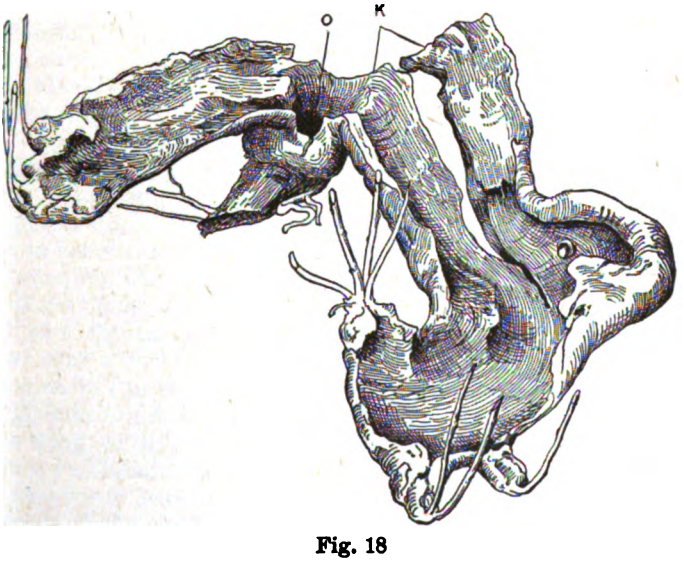

Fig. 18

Fig. 17.—Grub of white oak still older than number 16. There is a hole where the tap root has disappeared. The right hand portion is already dividing. In time, if killed back often, we might have several distinct oaks as descendants from one acorn or grub.

Fig. 18.—Part of grub of white oak, still alive and spreading over the ground the central portions dying, the margins alive and spreading.

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"The wheat contains of potassium five times as much as the beech, and nearly ten times as much as the pine; of phosphoric acid five times as much as the beech, and ten times as much as the pine; of sulphuric acid fifty-seven times as much as either tree."*

These three substances are the most precious ingredients of the soil, and the ones most apt to be rapidly reduced by heavy cropping.

Within the past thirty years I have observed several tracts of land of limited extent in Lenawee county, in southern Michigan, where severe winds had blown down most of the timber. This timber was composed entirely of deciduous trees, unless it be a few tamaracks in swamps. Fires were not allowed to spread over the ground, and very soon a thrifty young growth of mixed deciduous trees was fully occupying the ground. Not a pine, nor spruce, nor hemlock, nor any other cone-bearing tree, nor any chestnut nor birch could be found on high ground. Those last named were not to be found in that part of the State, hence there were no seeds nor young trees of these species ready to spring up when the first growth should be blown down.

During the past summer, I have had many opportunities of examining large tracts of land in Northern Michigan, where there were many kinds of coniferæ and various species of deciduous trees. In a trip by wagon from Lake Huron to Lake Michigan, I started with this subject strongly impressed on my mind. I have spent considerable time besides this, in visiting the forests and burned districts, and looking at the second growth and observing what was there growing. For example, at Harrison, near the center of Clare county, there is an admirable chance to study this subject. The soil varies considerably, though most of it is sandy.

In imagination let me conduct you to a fine virgin forest two or three miles southeast of the village. The land is rolling and thickly timbered with tall trees. We shall find much thrifty white pine and Norway pine, and in places, considerable hemlock. There are scattering trees of red maple, white and black and red oak, a little beech, and small white ash, some hazel, witch hazel, maple-leaved viburnum, New Jersey tea, mountain maple, large-toothed aspen, now and then a plant of dwarf huckleberry, blackberry, dewberry, eagle fern, sweet fern, dogwoods, choke cherry, black and pin cherries, June berry, and other shrubs and perennial herbs which are deep rooting. In some places the undergrowth is quite thick, but often the large trees are too thick to permit many small tree to grow, at least for them to thrive well enough to conceal the ground. The leaves are usually well packed to the ground, as they were when the snow melted last spring. Where the land was sandy, all of these leaves were dry enough to burn, and about July 25, fire had spread over a considerable tract of this land. There are evidences that fire has formerly run through these woods on several different years, killing the young timber and all under growth to the surface of the ground and often damaging or killing some of the larger trees. There are very few young pines and hemlocks, though cones are found in abundance. The thick layer of deciduous leaves on the ground leaves little opportunity for the delicate seeds of the coniferæ to produce trees.

Let us look for young deciduous trees.

Here are a few very slender oaks of two or three species, some that are eighteen feet high and less than one inch and a half in diameter near the ground; yes, and there is now and then one which has died to the ground, apparently smothered for want of light, but a few spindling sprouts are coming

* B E. Fernow, in AMERICAN JOURNAL OF FORESTRY, p. 71, 1882.

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up showing that life still holds out. On digging a few of these slender oaks, we find some of them come from clumped roots, or "grubs" of various sizes, showing that the present growth is the first, second, third or fourth sprout which has apparently come in succession from the same foundation; some of these old sprouts are now represented only by dead stumps, some of which are charred near the ground. By counting the rings of growth in the last sprout, or if small, the bud rings, we may tell very accurately how long since a fire killed the former sprout.

Below the denser growth of large trees we shall be able to find scattering oaks of various ages. On my last visit I brought home two white oaks and one red oak which still had the remains of the seedling acorns attached by the stems of the cotyledons. One of these was five years old. There are others, some four inches high, crooked little things, not the eighth of an inch in diameter, bearing only two or three small leaves. The marks of bud rings show that they may be four to ten years old. On examining some near the ground, we shall find a part of them are the first, second or third sprouts from a small clumped root or grub. It is not difficult to find white oaks under eighteen inches high that are twenty or more years old, and then, this may be the second, third or fourth sprout that has followed in succession, so it is not improbable, that in some cases seen, the parent root or grub was sixty to one hundred years old and the whole now not an inch in diameter anywhere above the ground. Then what shall we say of the age of some grubs which weigh thirty to fifty pounds each? Slender little red maples are rather common in this forest.

There are a plenty not over a foot high and an eighth of an inch or less in diameter that are without question from twenty to twenty-eight years old, and in some cases this is not the first growth, but the second, third or fourth of small size, in succession from the same root.

Some of these pigmy oaks and maples have old charred stumps near the surface of the ground. In like manner we find the other species above named, except that the young hemlocks and pines show no dead charred stumps with living sprouts beside them.

As I formerly stated, in one place about the first of August, the fire had killed for a considerable extent nearly all the small growth of trees and shrubs. Of course there were no signs of sprouting as the observation was made while some of the fires were still burning.

Let us examine an adjoining piece of land of the same character from which nearly all the timber was cut and removed last winter.

Late this spring the fire had swept over this stump land giving it "a good burn."

About August 1st the following sprouts were seen coming up from old stumps, large or small, or from root stocks. To give the complete list of those seen growing in this clearing would be to repeat the list seen growing in the woods near by, except that no pines nor hemlocks were seen on the burned stump lands. On the latter piece were discovered some dog-bane (*aporynum*), one or two wild roses, a milkweed, a dwarf willow, a bush honey suckle, (*diervilla*). These were not mentioned in my list found in the forest, but they are now evidently growing from old root stocks.

No seedling plants of any kind were large enough to make any display, and very few seedlings of any kind were seen. A few poplars were seen on

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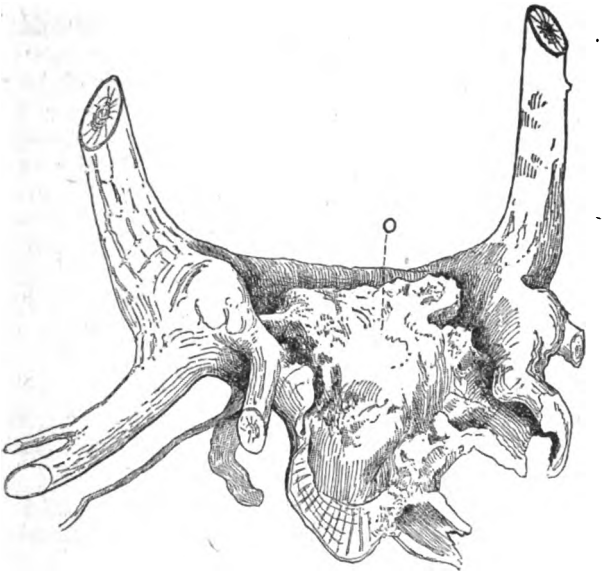

Fig. 19

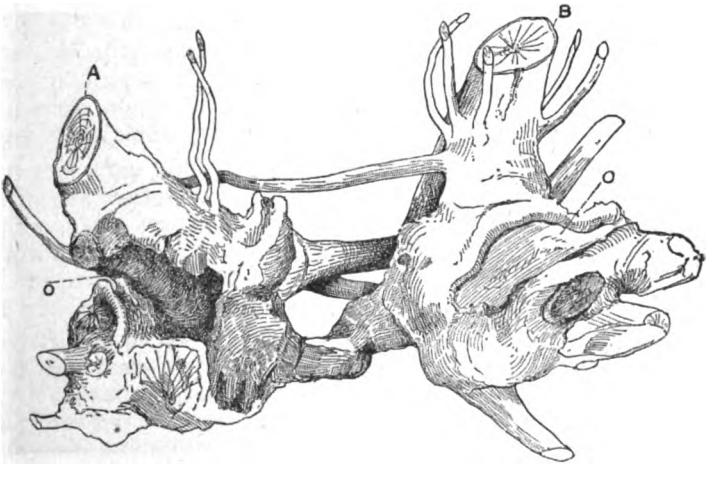

Fig. 20

Fig. 19.—Grub of black oak dying in the middle, where it has been killed back more than once. In the process, if killed a few times more, of assuming the shape of the next figure.

Fig. 20.—Grub of black oak still united, though probably at one time it was much like Fig. 19. Observe that spots O O are dead, and in time each half of this specimen might be separated, as the present group is now separating.

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the burned land, and these were the large-toothed species, and all came from sprouts from former small trees. A little nearer town is an older piece of stump land, from which the timber was cut two years ago, and some from which the timber was cut still longer ago.

On the older stump lands the sprouts have grown higher, and have spread considerably. Some weeds have made their appearance.

In places, there are small aspens and some birches, especially on low ground. Seeds of aspens, everybody should know, spread freely in the wind, while those of birch often remain to some extent till into winter, and are often blow on top of the snow for long distances.

In another part of the State near Baldwin, in Lake county, virgin forests and stump lands of various ages were studied. The condition of trees and shrubs in nearly every particular corresponds with that given for Harrison.

Let us now turn our attention for a few moments to a very different state of things—a study of the sandy barren plains known as the pine barrens, or Jack pine plains.

About seventy-two species of flowering plants are very uniformly found on these plains. Of this number, sixty-eight are perennials, including a dwarf willow, three dwarf cherries and many other low shrubs.

The number of trees in this list is a small one, and includes two aspens, three oaks and one pine, with occasionally two other pines.

All of the above seventy-two species are admirably adapted to poor soil, to long droughts and frequent burning by fire, with the exception of the biennials and the White and Norway pines. The last two only occur occasionally and come from seeds drifted on to the plains from neighboring territory. The oaks survive the fires for many times in succession in a manner previously mentioned.

I need now only speak of *Pinus Banksiana*, popularly known as Jack pine, gray pine or scrub pine, to show how admirably it is adapted to living on these sandy plains. In many places it is about the only tree growing, and always on these plains it is found in large or in small numbers.

The tree is often killed by fire and never sprouts from the stump, as is the case with oaks, willows, cherries and others. The Jack pine grows readily and rapidly from seed on the sand. It begins to bear cones and seeds in abundance while yet only a few years old, perhaps as young as five years in some cases. These cones in many cases open slowly, some of them never opening to part with their seeds.

We often see cones of this species which are to all appearance perfect, that are ten or fifteen years old, and yet the scales have never spread to liberate their seeds. Unusually dry weather, the death of the tree, or heat from the fire running over the ground, or all of these, cause many of these stubborn old cones to open and allow the seeds to escape. This often happens after the fire has killed every green thing above the surface. In a little time the seeds of Jack pine are freely sown over the surface and are ready to start on the approach of warm weather of the succeeding spring. During the past summer I picked from a single Jack pine tree a lot of cones which were, according to my judgment, from two to four years old. They were placed in a tin dish under glass and exposed to the sun. The cones all opened and many seeds were obtained. These were sown in sand in the laboratory and in five days

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began to come up. In a short time, 120 out of 125, or about 95 per cent, germinated.

At the same time, from the same tree, I selected old cones which I believed to be from four to six years old at least. From these, 225 seeds were sown, 191 of which germinated, about 85 per cent.

In considering this subject, many are puzzled to account for the production and distribution of seeds from which trees may be started. I will only say here in brief, that in all the cases studied, there were trees in the immediate vicinity old enough and large enough to produce nuts or seeds in abundance. When we consider how long some of the small trees live before attaining much size, and that they often come from old "grubs" very much older, we see that a very light crop of seeds on scattering trees, even once in ten to twenty years, would be sufficient for stocking the ground. Then again, the trees which produced the seeds may have perished long ago, and yet the stunted, slow growing seedlings survived as above shown.

I have seen blue jays carry and drop acorns a long way from the trees on which they must have grown. We know that woodpeckers and crows and sometimes pigeons carry some nuts and seeds for long distances.

I have often seen red and gray squirrels carry nuts twenty to forty rods from where they were picked up at the foot of the parent tree and then bury them in the soil a few in a place. There is no lack of reliable evidence of this character from many good botanists to account for a free distribution of nuts and seeds.

I feel confident that in an hour or two spent in certain favorable places, I could fully satisfy any intelligent person, unless he be unusually stubborn, that it is an easy matter to prove that new forests spring from seeds or the stumps of the old, and that where the second growth is in some respects unlike the first, the change is accounted for in a rational manner.

LARGE TREES.

[BY W. J. B.]

I need not repeat here, but only refer to some measurements of large trees noticed in a paper for the Michigan Pomological Society for 1876.

The "Jack pine," as it is almost universally called in our State, is *Pinus Banksiana.*

Dr. Gray, in his Manual of Botany, speaks of it as a straggling shrub or low tree, five to twenty feet high. On the upper Manistee, at Aurora Frazer's, we measured one of these trees two feet above the ground that was four feet eight inches around, and another four feet and nine inches.

At Walton in Grand Traverse Co., I measured one which took just five feet of the line. In Kalkaska county we measured a white pine thirteen feet six inches around, and another was sixteen feet three inches around.

At Fife Lake, they tell of one within a few miles that girts twenty-three feet and six inches. Near the latter place is an American elm said to be seven feet in diameter.

At Elmira, I measured an elm log that was four feet in diameter. I counted over two hundred and fifty rings.

At Frankport, a nice pin or red cherry, *Prunus Pennsylvanica* L., had a circumference of three feet and four inches

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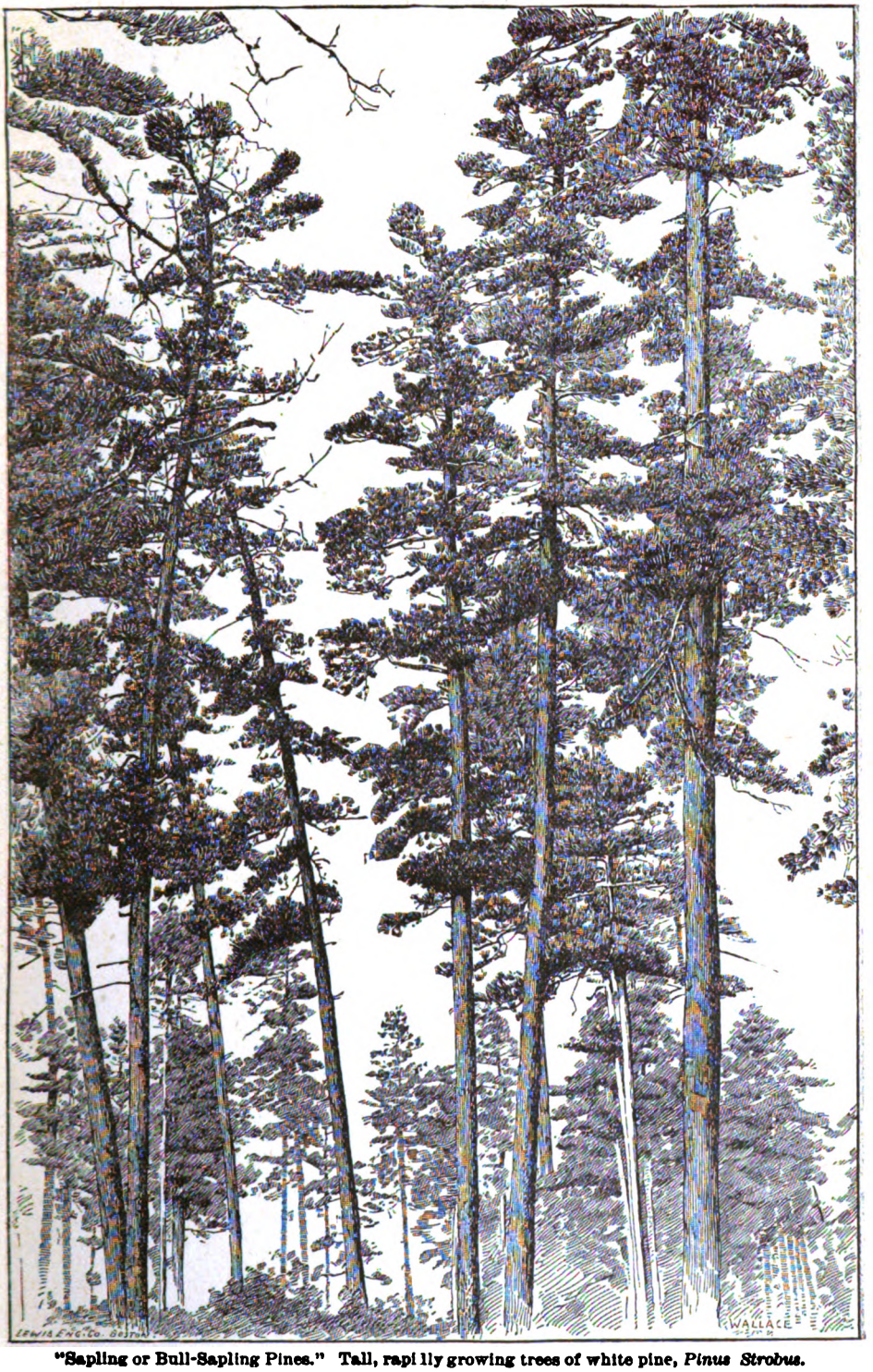

"Sapling or Bull-Sapling Pines." Tall, rapi lly growing trees of white pine, *Pinus Strobus*.

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The modern mode of felling pine trees.

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At Garfield, in Grand Traverse county, an ironwood was seen with a diameter of twelve inches; a yellow birch, with a circumference of eleven feet ten inches; an arbor vitæ or white cedar, eleven feet two inches.

West of Kingsley, in the same county, there is an arbor vitæ with a circumference of thirteen feet nine inches, almost four feet and four inches in diameter.

In Garfield, a sugar maple was seen that was ten feet in circumference.

In the eastern part of Kalkaska county, we measured a solid and sound stump of a Norway or red pine that was circular and three feet three inches in diameter.

Prof. V. M. Spalding counted the annual rings on a hemlock log two feet in diameter and found 342 of them. On a tree of Norway pine, the same size, there were 210 rings; the slow growing sap of the latter was 60 years old.

THE NAMES OF PINE TREES AS KNOWN TO LUMBERMEN.

[BY W. J. B.]

The botanist will tell you that in Michigan, there are three and only three species of pine, while the lumberman says there are eight or ten. He applies the term "buckwheat pine" to a thrifty, usually young tree of white pine which has a large, low top. It is of no value for lumber or timber. Occasionally some call a tree of *Pinus Banksiana*, "buckwheat pine" if it has the shape above described.

"Sapling" or "Bull sapling," is a name applied to a tall and thrifty white pine with a good top. The branches are rather numerous, the limbs extending downwards pretty well. Such a tree is making a good annual growth and has a thick sap with a relatively small amount of heart wood. The boards will contain many knots, solid or loose, and do not take high rank in the market.

A sapling pine is improving, and in time would become "cork pine." A cork pine is a white pine which has seen its best days. The top is small, and very likely partially broken off or dead; the tree has made only a slow growth for many years, and has a thin sap and much heart wood. The lower limbs have long since disappeared, as the tree has grown among other trees standing thickly around it. The wood of cork pine is ripe and soft, and very nice to work with saw and plane, and finishes into good doors, sash, blinds and furniture.

The red or "Norway pine" (lumbermen universally call it by the latter name) is called "black Norway" when the trees are low and have large tops and a relatively large proportion of sap wood. A tree is "yellow Norway" when it is tall with a small top, when it is making a slow growth and has but little sap wood.

Where trees of *Pinus Banksiana* are short, with large, wide tops, and the proportion of sap wood large, they are called "black jack pine." Where they are crowded, tall, with small tops and a large proportion of heart wood, they are called "yellow jack pine."

CUTTING AND REMOVING LOGS FOR LUMBER.

[BY W. J. B.]

Lumbering in our State has long been conducted on a magnificent scale, though many of the processes are wasteful. Rivers are dammed, lakes over-

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flowed or drained, the forests deprived of vast quantities of young trees, which ought to be left to produce more timber for the future. Desolation follows the track of the lumberman. All of the beauty and most of the value is removed from the land where the timber has been removed. Stumps, rubbish, the poor trees, the small young trees are burned or charred and the ground left to grow up to briers, pin-cherries, poplars, birches, willows, scrub oaks and other worthless trees and plants.

The lumberman cuts and removes the best, leaving the remainder in condition for the fire to certainly follow and destroy it, and moves on to treat one section or township after another in a similar manner. He is after money and is often doing little to improve the country in any respect. To make amends for all this he should accomplish great good elsewhere. We can not help thinking that so far as his ability lies, the poor fellow who follows the lumberman in attempting to improve the land and make a comfortable home is a greater patriot, and deserving of more credit from the State than the man who merely cuts and removes the timber.

All honor to the man who does what he can to improve the country by cultivating fields, planting orchards, building nice houses and good roads!

The changes in the processes of conducting the lumber business within the past few years have been rapid, and each succeeding process more thorough.

The primitive modes of felling trees with the ax and then cutting off the "butt-end" to make it "square," have long since passed away, as has also the custom of drawing a log or two at a load to the river or the mill. Getting in logs once depended on the arrival of snow. About ten years ago there was but little snow all winter. Very few logs were drawn, though many were cut. Logs must be had at the mills to keep business moving. Tramways or pole-roads were devised. Two poles about eight inches in diameter were placed three and a half to five feet apart and fastened to ties. On the poles were cars drawn by horses. These pole-roads were not a great succes, and have not been used much before nor since about the year 1878. On a small scale snow or ice has been drawn to make a road for a sleigh.

For ten years or so, it has been customary to take much pains in grading roads for teams during the summer, sometimes at a cost of one thousand dollars per mile. The grade is very carefully selected, the road made about eight feet wide, with a ridge on each side to keep the load from slewing.

There must be room to let pass a load twelve to fourteen feet wide.

As soon as cold weather approaches, the sprinkler is set to going. This consists of a box four by four feet and sixteen feet long. They usually wait for a little snow to make it easy to start the sprinkler. In one case, when snow delayed Park, Woods & Company, drew from a lake chunks of ice and broke them up along several miles of road. On this the sprinkler was started and logs were then soon seen on the road. The sprinkler is filled by a horse and two men who make use of a rope and pulley to draw the barrel up an inclined plan over the top of the box on the sleigh. The sprinkler, after the road is once passable, runs only during the night, as it must keep out of the way of the loads of logs. Snow is not thought to be of much use, as it is scraped off as soon as it comes.

The trees are felled and cut into lengths by cross-cut saws of improved patterns which require scarcely more than one-third the time and effort required by the old implements.

To leave the carefully constructed road free from all obstruction for heavy

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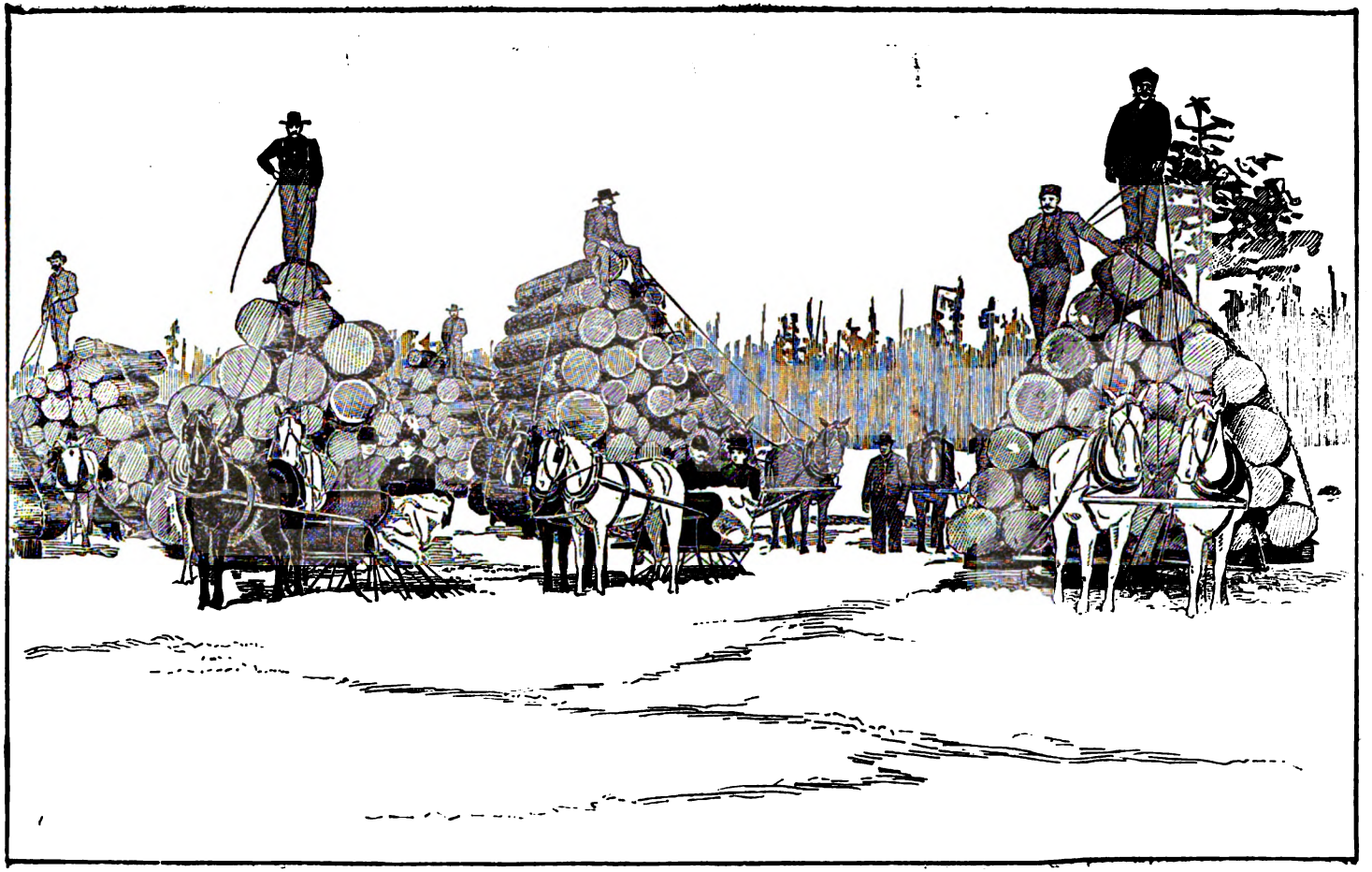

Loads of pine logs at Beaver Lake.

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The largest load of pine logs ever drawn by one team—30,068 feet, board measure. This was drawn by a team owned by Park, Woods & Co., Oscoda.

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loads of logs to descend to the river or the railway, there is an inferior "go-back road" for the use of teams returning empty. The size of loads of logs drawn by one team of horses is enormous. A photograph of such a load strikes a stranger as one of extraordinary size, and he supposes it was put on just to create a sensation and make a fine display in a picture. The sleighs are very stout, with two heavy cross timbers or bunks, often long enough to permit of a load twelve feet wide. The ridges at the sides of the roads prevent the sleighs from getting off the track; the nice grade carefully avoids ascents of much prominence in the direction of heavy loads. The road is a solid bed of ice, often more favorable for drawing large loads than the thick ice on a pond or lake. A load of logs scaling 3,500–5,000 feet board measure is a good load, and is as much as is placed at one time on one railway car. Five tons of such logs make 1,000 feet of lumber. Marsh hay, straw, manure, sand, or other materials are often used where the descent is too abrupt for a team to carry the load easily.

In 1884, a team of apparently grade Clydesdales, weighing 3,100 lbs, belonging to Park, Woods & Company, of Oscoda, drew, at one load, for about a mile, pine logs enough to scale thirty thousand and sixty-eight (30,068) feet, board measure. The logs were mostly sixty feet long, and after cutting shorter for the mill were rescaled and measured over 31,000 feet. The writer has a photograph of this team, load, driver and foreman. The latter gentleman is L. H. Smith. This great feat was performed about twenty miles east of Grayling, in Crawford county, Michigan, and is believed to be the largest load of logs ever hauled on runners by any one team.

When there is no snow on the ground, and the weather is not cold enough to form ice, many logs are drawn for a mile or two on large "wheels," trucks, or, as I should call it, a "cart," having wheels seven to nine feet in diameter. Logs of any length, as long as a tree will make, are slung up under the axle so they will nearly balance. A team is hitched to one end of these logs, and all move off to the lake, the railroad or the mill where the logs are wanted.

They are unloaded quickly, sawed into suitable lengths, each end branded, and very likely soon start on a long journey down a river or on the cars.

The following practice in drawing logs to the railroad is now common:

Long timber—whole trees 50 to 100 feet or more long, are drawn in summer for nearly a mile with one to three span of large horses. The logs are rossed on one side, a log-boat or drag is placed under the front end of the logs which are drawn, one at a time, across other smooth logs which are placed once in about every twenty feet for the whole length of the road.

In 1876, C. Rominger, in the Michigan Geological Report, made the following statement in regard to getting logs to the mills. At that time it seemed to be true:

"The greatest portion of our world-renowned stores of pine timber would be comparatively worthless to the owners, and to the community at large, without these rivers. The rivers are of vital importance to the lumber business as medium, for the transportation of felled timber, from otherwise almost inaccessible parts of the interior, to ports or railroad stations."

At the present time immense quantities of pine logs are every year floated down the rivers of northern Michigan. About 230,000,000 feet will this year go down the Au Sable. The logs are all marked in four places on each end, and subject to certain taxes of boom companies who engage to get the logs safely to their place of destination. The owners of the logs usually raft the

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logs down the stream for a certain distance before the boom company takes them. When the water is high enough for moving the logs, men accustomed to the business are stationed at crooked places along the river to keep the timber moving downwards. At certain times they roll all the logs lodged along the shore into the river and clean them all up, "taking off the rear." When the river is rather low, it is sometimes flooded for a part of the day by letting the water form dams in some side stream or in some adjacent lake. In a very dry time the logs stop in various places, waiting for a rise in the stream, and are then said to be "hung up."

The boom companies pay good wages to their men, who are a rugged set of fellows. The work is quite exposing and sometimes dangerous. The men often dress in a showy, checked or gay colored heavy woolen shirt and pantaloons, the latter tightly enclosed at the bottoms of the legs in tall heavy boots which are well made of excellent materials. The thick soles of these boots contain numerous sharp steel nails with points protruding three-eighths to half an inch. Armed with peavey or pike pole each one is at home on the river. He can ride a single log and use it as a ferry boat across a rapid stream, in some cases it is said, ferrying his wife from one shore to another.

Rafting logs down the rivers is not in as high repute as formerly. There are many long delays. Logs are lost in one way or another; some of the sappy Norway pines sink and are lost in that way as they change the current and become covered with sand or mud. The tax of boom companies is high, and in some cases their rules are arbitrary.

Narrow gauge roads have become very common. These often have steep grades and sharp curves. The tracks are removed from place to place to keep near the timber. Wide or standard gauge roads are becoming more and more common for carrying away the timber. Even along the Au Sable there is now a prospect that there will soon be a railroad to transfer the logs instead of trusting them to the water-course.

There are two or more roads of standard width which extend through a crooked course to the west side of Alcona county. There are numerous branches. The cars consist of two sets of trucks, each of four wheels, held together by a reach thirty feet or more in length. Logs fifty to one hundred or more feet in length are placed on contiguous ends of two of these trucks and held there by heavy chains. About twenty such lengths of long logs make enough for one train. The logs are taken to Lake Huron, made into large rafts and drawn by steamers down the lake, often as far as Buffalo, New York. There may be other such roads in the State, but the writer has not seen them.

Portage lake is about five miles long and is west of Grayling about four miles, in Crawford county.

Long logs in summer are cut and drawn with large wheels to the banks of the lake, where they are cut into logs of proper length. They are rolled into the lake and taken by a tug to the northwest side, where a steam engine runs an endless chain up an inclined plane. This carries the logs from the lake at the rate of 2,500 in a day. They are rolled onto the cars of a narrow gauge railroad by horses and chains, drawn three miles and dumped into the Manistee to begin a slow and rough voyage down to Lake Michigan.

H. M. Loud & Sons, of Oscoda, operate what is called a steam skidder. It acts after the manner of a steam plow, and will draw the logs back sixty rods or more on each side up to the railroad track. Another small engine manages a crane which holds a huge pair of tongs which grasp the logs near the middle and puts them on the cars.

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A LUMBER CAMP.

[BY W. J. B.]

In season, this is a busy place of great interest to one not accustomed to such things. One or more low, one-story buildings are made of logs a foot or more in diameter. The houses may be thirty feet wide and fifty or more in length. One or more will be used for sleeping. On either side are wide bunks, two stories high. In one corner of the room are barrels of water, tin basins, soap, towels, and a small mirror. There are boot-jacks, bits of logs for seats, a rough card-table, and there is a leaning chair made of boards for the use of the man who is to be barbered.

The dining-hall looks much like the lodging room, only two rows of long tables with oil-cloth covers stand lengthwise of the room. Near the table are rough benches, and for the meal substantial food like potatoes, bread and butter, pork and beans, fresh beef, and coffee, are supplied in abundance and eaten with apparent relish. The rough unhewed logs on the inside of the room are often covered with newspapers or pictorial magazines. The barns, the office, and perhaps other buildings are often constructed in the same manner as above described. At these camps, travelers can procure meals, as at a tavern, paying the customary price of twenty-five cents.

Some camps employ one hundred or more men the year round. As the timber is removed, the old quarters are deserted and new ones erected.

The men employed are natives of various countries, as Ireland, Germany, France, Norway, Sweden, England, Canada, America. Men of color are unpopular, and are not often met with. In cutting and moving logs the men are considerably exposed to danger. Insurance companies are well patronized, and a moderate annual fee ticket to a hospital is still more popular. Here in case of accident or sickness they are treated free of further expense.

Large camps are often supplied with a store of goods such as are liable to be wanted by the laborers and others in that part of the country.

NEW USES FOR CERTAIN KINDS OF TIMBER.

[BY W. J. B.]

Not many years ago the timber of American elm was considered worth nothing. It is soft, often hard to split and warps badly. To-day, this spongy timber from trees grown on wet soil in a dense forest is valuable for many purposes. The timber is steamed and bent for tops of wheelbarrows, the sides of cheese boxes and many other articles. It is steamed and cut for hoops of barrels, where it was a few years ago considered of no value. Small logs of the aspen were not long ago considered of no value. They have for a few years been much used for making paper. In like manner, freshly cut logs of spruce and balsam fir are now used for making pulp, which is converted into excellent white paper. These changes will affect the selection of species for growing.

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THE AMOUNT OF PINE YET REMAINING IN MICHIGAN.

[BY W. J. B.]

There have been made on this subject many statements wide of the truth, and some severe criticisms have been made on the figures of the so-called "alarmists," but there would be less difference of opinion, if all parties understood each other.

The following was clipped from an editorial of *The Lumber Trade Journal* of Sept. 15, 1888, edited by G. W. Hotchkiss. It explains some of these causes of "misunderstanding" as to the supply yet remaining in our State:

"We concede that if saplings of four inches diameter, dead trees, cutting 80 per cent. mill culls, hemlock, basswood, oak, maple, elm, sycamore and cedar are to be figured against the estimates of standing pine, then our estimates as given to the census bureau were altogether wrong. If we were warranted in basing our estimates upon a lumberman's standard of what constitutes merchantable timber, then we maintain that 35,000,000,000 feet was an over-estimate rather than too low. What is timber? 'Timber is a merchantable grade of material such as will yield a profit to the manufacturer in its cutting, to the dealer in handling, and be available for all commercial purposes.' In 1880 timber was bought upon a basis of its yielding not over 10 per cent. culls, on which the lumberman did not expect to realize the cost of stumpage, logging and sawing. A fair estimate of the entire pine lumber cut of 1887 would place the culls (mill and shipping) at fully 40 per cent. In 1880 the proportion of Norway to white pine was not over 10 per cent.; in 1887 it was fully 50 per cent. In 1880 it was so lightly esteemed that Norway stumpage was undesirable at 50 cents; in 1887 it was sought for at $2 to $3, and sales have been made at double those figures. In 1880 the average white pine cargo of boards at the Chicago market would 'pick' 40 to 70 per cent. 'C' and better, and it is safe to say that 45 to 50 per cent. cargoes were the rule rather than the exception. In 1887 the average cargo of inch boards on the Chicago market ranged from 10 to 20 per cent. 'C' and better, with the 20 per cent cargo occupying the same relative positions in the purchaser's mind that the 70 per cent. cargo did in 1880. To a novice these facts and figures are of little importance; to a lumberman they are as full of meaning as an egg is full of meat. In 1880 a log under twelve inches could scarcely find a market; in 1887 there were mills in Michigan cutting logs of six inches diameter. In 1880 the average log in Michigan, taking the State as a whole, was over 200 feet. In 1887 the average was under 100 feet. To a simple casual observer there is abundance of pine in Michigan; to him who knows and appreciates present conditions, it is apparent that for every acre of virgin forest which is now available for lumbering, there are ten to twenty acres which are being cut over the second, third and fourth time—largely the third and fourth. From these considerations we are led to modify our original statements only to the extent of questioning the correctness of our judgment as to cutting being done in Michigan for a hundred years to come, for the reserve is being cut very rapidly at present.

"To a close observer the towing of immense rafts of logs from Lake Superior and the Georgian Bay to the Saginaw river is indicative of a waning supply from the sources hitherto relied upon. To the casual observer constantly arriving cargoes at the Chicago market is indicative of exhaustless supplies at shipping points. To the discerning mind a constantly reducing average quality is indicative of a waning supply of commercial stock. To one who cannot distinguish the difference between culls and clear, a board is a board, no matter if it be fit only to make a hog pen, or must be cut into small pieces with heavy waste to be utilized. At the best the vast forests of Michigan have melted away until the most optimistic view can but acknowledge that its end is in sight. A year or ten years' continuance of the products of gleaning cuts but little figure in the general proposition."

As the best pine disappears some of the timber will remain uncut and withheld from market for better prices. Pine will be cut closer, the small and that of poor quality will find quick and profitable sale, where in former years it would not be noticed. A large use of hard woods, importations from other sources, substituting other materials where wood has formerly been employed, will all tend to prolong the supply of pine timber beyond the estimates often made.

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"Black Norway Pines." Low, rapid growing trees of red or Norway pine, *Pinus resinosa*.

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"Yellow Norway Pines." Tall slow growing trees of red or Norway pine, *Pinus resinosa*.

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LIST OF TREES AND SHRUBS BELONGING TO MICHIGAN.

[BY W. J. B.]

MAGNOLIACEÆ—MAGNOLIA FAMILY.

Liriodendron L.

L. tulipifera L. White-wood, Tulip-tree.

A fine, large tree, valuable for timber and ornamental planting; not found in northern Michigan, but found from Ionia and Saranac southward.

ANONACEÆ—CUSTARD-APPLE FAMILY.

Asimina L.

A. triloba Dunal. Pawpaw.

A large shrub or small tree, often spreading by the roots. The fruit variable, thicker and shorter than a banana; very likely it may be improved and become valuable. From the Grand River Valley southward.

MENISPERMACEÆ—MOON-SEED FAMILY.

Menispermum L.

M. Canadense L. Moon-seed Vine.

A neat, clean vine bearing maple-shaped leaves; the two sexes of flowers on different plants. Well worth cultivating. A form was found at Mio with the leaves deeply lobed.

BERBERIDACEÆ.

Berberis L.

B. vulgaris L. Common Barberry.

An interesting shrub, not often found out of cultivation, but spreading in the vicinity of the Agricultural College.

HYPERICACEÆ—ST. JOHN'S-WORT FAMILY.

Hypericum L.

H. Kalmianum L. Kalm's St. John's-wort.

A bushy shrub, one to six feet high, sometimes cultivated for its large yellow flowers. From central Michigan northward.

H. prolificum L Shrubby St. John's-wort.

A low shrub; sometimes cultivated as the preceding.

TILIACEÆ—LINDEN FAMILY.

Tilia L.

T. Americana L. Basswood. Linden.

A soft wooded tree valuable for timber, for shade and for honey. Low rich land, common.

RUTACEÆ—RUE FAMILY.

Xanthoxylum Colden.

X. Americanum Mill. Prickly Ash.

A bitter prickly shrub twenty feet high, bearing small red berries. Common on low lands.

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Ptelea L.

P. trifoliata L. Hop-tree. Shrubby Treefoil.

A thin, straggling shrub ten feet high, sometimes cultivated. Montcalm county and southward.

ILICINEÆ—(AQUIFOLIACEÆ) HOLLY FAMILY.

Ilex L.

I. verticillata Gray. Winter-berry. Black Alder.

A neat shrub two to six feet high, bearing an abundance of bright red berries which often remain till late in winter. Low land. Sometimes cultivated.

Nemopanthes, Raf.

N. Canadensis DC. Mountain Holly.

A shrub six feet high, bearing red berries. Swamps and low land. Montcalm county, southward.

CELASTRACEÆ—STAFF-TREE FAMILY.

Celastrus L.

C. scandens L. Climbing Bitter-sweet. Wax-work.

A climbing shrub with a stem sometimes two inches in diameter. The orange-colored berries open and expose the red seeds which remain into winter. Sometimes seen in cultivation. Flowers of two sexes on different plants.

Euonymus L.

E. atropurpureus Jacq. Waahoo. Burning-Bush.

A clean shrub, six to ten feet high, bearing berries much like the preceding. Cultivated.

E. Americanus L. var. obovatus T. & Gray. Trailing Strawberry Bush. Common, but seldom very conspicuous.

RHAMNACEÆ—BUCKTHORN FAMILY.

Rhamnus L.

R. alnifolia L' Her. Buckthorn.

A low inconspicuous shrub; marshes and river bottoms; common.

Ceanothus L.

C. Americanus L. New Jersey Tea. Red-root.

A bushy plant three feet high, bearing panicles of white flowers, well worth cultivating, but rather difficult to transplant. Sandy woods, common.

C. ovatus Desf.

Much like the preceding. Oscoda to Crawford county and northward.

AMPELIDEÆ (VITACEÆ) VINE FAMILY.

Vitis L.

V. æstivalis Michx. Summer Grape.

A beautiful glaucous vine, with leaves varying much in shape. Rather common northward.

V. riparia Michx. Frost Grape.

Berries very sour. Along streams, common.

Ampelopsis Michx.

A. quinquefolia Michx. Virginia Creeper. Five-leaf Ivy.

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Our most beautiful native vine; often cultivated. Some plants cling well to brick walls; others will not; all will cling in the manner of grape-vines. Common.

SAPINDACEÆ—SOAPBERRY FAMILY.

Staphylea L.

S. trifolia L. Bladder-nut.

A pretty shrub, ten feet or more in height, bearing drooping clusters of white flowers, followed by bladder-like pods an inch in diameter. Sometimes cultivated. Not uncommon.

Æsculus L.

Æ. glabra Willd. Ohio or Fetid Buckeye.

Western Lenawee county, and probably elsewhere south. The tree has a thin top, and is not so handsome as the horse-chestnut.

Acer L.

A. Pennsylvanicum L. Striped Maple. Moose-wood.

A beautiful slender shrub with a single trunk, twenty feet high; bark striped; leaves large. Northern Michigan.

A. spicatum Lam.

A neat branching shrub, twenty feet high. Low land; Lansing and northward.

A. saccharinum Wang. Sugar Maple. Rock Maple.

One of our most common and well known trees. A general favorite for the road, though often troubled by borers.

A. nigrum Michx. Black Sugar Maple.

Not to be distinguished from the preceding by the color of its trunk, but by its stipules, dark drooping leaves which are often pubescent. Found with the other in the central and southern part of the State.

A. dasycarpum Ehrh. Silver or White Maple.

A rapid growing tree bearing long branches, the lower of which are slender and drooping, often planted as are also the two preceding. Along streams, common.

A. rubrum L. Red Maple.

A slow growing tree with gorgeous red and scarlet leaves in autumn. Low lands, common. This and the preceding are often confounded and indiscriminately called "the soft maple."

Negundo Mœnch.

Vn. aceroides Mœnch. Box-elder. Ash-leaved Maple.

A small, crooked tree with green branches. Along streams, central Michigan and south.

ANACARDIACEÆ—CASHEW FAMILY.

Rhus L.

R. typhina L. Staghorn Sumach.

A thin shrub, often spreading by suckers, the stem sometimes six to eight inches in diameter, the pinnate leaves early turning red in autumn; the sour berries are also red and remain till into the winter. Sometimes cultivated. Common.

R. glabra L. Smooth Sumach.

Much like the preceding, only the young branches are smooth. Common.

R. copallina L. Dwarf Sumach.

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A neat shrub four feet high; common on light soil.

R. venenata DC. Poison Sumach. Poison Dog-wood.

To some persons, poisonous to the touch. A fine shrub, and were it not poisonous would be cultivated. Swamps, common.

R. Toxicodendron L. Poison Ivy. Poison Oak.

A trailing shrub or a stout vine clinging to trees by roots. The three leaflets distinguish this from the Virginia creeper.

R. aromatica Aiton. Fragrant Sumach.

A low shrub three feet high, bearing red fruit. Worth cultivating. Not usually common, mostly found on bluffs and sand hills.

LEGUMINOSÆ—PULSE FAMILY.

Cersis L.

C. Canadensis L. Red-bud. Judas Tree.

A broad-topped shrub ten feet high, bearing pink flowers before the leaves appear in spring. Rather tender in cultivation. Along streams; Grand River valley and southward.

Gymnocladus Lam.

G. Canadensis Lam. Kentucky Coffee-tree.

A thin-topped tree, bearing a very few clumped branches which carry large compound leaves. The tree has some other striking peculiarities, such as the thin rolled bark, heavy pods an inch and a half wide; a durable red wood. A small tree, sometimes sixty feet high. Low land. Montcalm county and southward; not abundant.

Gleditschia L.

G. triacanthus L. Honey Locust.

A thorny tree with a thin top of crooked limbs. Wood durable; trees sometimes planted for hedges. A tree sometimes two feet or more in diameter. Occasional, along streams in the southern counties.

ROSACEÆ—ROSE FAMILY.

Prunus L.

P. Americana Marshall. Wild Plum.

A well known shrub, on low lands of the southern peninsula. The fruit red or yellow and very variable, indicating that it might easily be improved by cultivation and selecting seedlings. It suckers freely; the flowers are sweet-scented and sometimes staminate or pistillate.

P. pumila L. Sand cherry. Dwarf cherry.

A low, hardy shrub, bearing variable fruit; promising for cultivation after selecting for a few generations. Barren lands of the north and along the great lakes. Worthy a place as an ornamental bush in almost every collection of much size.

P. Pennsylvanica L. Wild Red or Pin Cherry.

A neat, tree-like shrub, having the aspect of a peach tree. From Ionia northward. In places much affected with a fungus causing black-knot.

P. Virginiana L. Choke Cherry.

A very pretty shrub, spreading freely by suckers. When in flower, there are few shrubs more beautiful. Subject to black-knot. Moist land, common.

P. serotina Ehrh. Wild Black Cherry.

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A well known tree of medium size, with a rather thin top producing racemes of white flowers, followed by black fruit which varies much in size and quality. The fruit is a favorite of the birds; the leaves a great resort for tent caterpillars; the wood is durable, of a red color, and much used for furniture. Common, though the trees are usually very small at the north.

Spiræa L.

S. salicifolia L. Meadow Sweet.

A clean shrub, bearing white flowers. Common in marshes and low grounds.

S. tomentosa L. Hardhack. Steeple-bush.

A low shrub, bearing pretty pink flowers. Worthy of cultivating and experiments with seedlings looking towards improvement. Ionia and southward.

Neillia Don.

N. opulifolia Benth. and Hook. Nine-bark.

A branching shrub six to eight feet high, with re-curved branches which retain the loose, thin layers of bark. Flowers white. Just the thing for a bank a little remote from the house. Common along streams.

Rubus L.

R. odoratus L. Purple Flowering Raspberry.

An attractive shrub with large simple leaves and broad compressed fruit an inch wide. Wet places, northward.

R. Nutkanus Mocino. White Flowering Raspberry.

Upper Michigan.

R. strigosus Michx. Wild-Red Raspberry.

A well known shrub, spreading freely by suckers. Fruit red and delicious; the parent of many varieties in cultivation. It has been hybridized with the black-cap raspberry. Common, especially northward.

R. occidentalis L. Black Raspberry. Thimbleberry.

Too well known for its valuable fruits and as the parent of many cultivated varieties; it needs no description here. Fruit sometimes of a cream color. Common, extending to Grand Traverse county on the west side of the State.

R. villosus Aiton. Blackberry.

Common in woods and thickets, spreading rapidly by suckers. Rather variable; fruit sometimes cream colored. Many varieties are cultivated for their fruit.

R. Canadensis L. Dewberry.

Fruit sweet. Some varieties found in cultivation. Old fields; poor land, common.

R. hispidus L. Running Swamp Blackberry.

When exposed to sunlight the leaves assume a rich copper color, and with the slender stem are fine for decorating churches, halls and school-rooms. Abundant in the sands of central and northern Michigan.

Potentilla L.

P. fruticosa L. Shrubby Cinque-foil.

An erect thick shrub, two to four feet high, bearing silky leaves and showing yellow flowers. Wet grounds, common.

Rosa L. [The roses are very variable and difficult to define.]

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R. Carolina L. Swamp Rose.
A neat showy shrub; common in swamps.
R. pauciflora Ehrh. Dwarf Wild Rose.
A small pretty rose. Dry soil; common.
R. blanda Aiton. Early Wild Rose.
Very variable and common northward.
R. Sayi Schwein.
An erect shrub two to six feet high. Sandy plains, Iosco and Oscoda counties and most likely elsewhere.
R. acicularis Lind.
Found with the preceding.
R. rubiginosa L. Sweet Brier.
Pastures; roadsides not uncommon.
Pirus L.
P. Malus L. Common Apple.
Not uncommon; escaped from cultivation.
P. coronaria L. Wild Crab-apple.
A rough-barked tree-like shrub bearing a profusion of very sweet pinkish-white flowers. Fruit very sour. Common in the central and southern parts of the State.
C. arbutifolia L. Choke-berry.
Swamps; Ionia county and northward.
C. arbutifolia L., var. melanocarpa Hook. Choke-berry.
Swamps northward to the center of the State.
C. Americana DC. American Mountain Ash.
A large tree-like shrub, fully as handsome as the foreign species in cultivation.
Cratægus L.
C. coccinea L. Scarlet-fruited Thorn.
A very variable and beautiful hawthorn, capable of trimming into almost any shape. Not as often seen in cultivation as it should be.
C. subvillosa Schrader. Downy Thorn.
A small tree twenty to thirty feet high, sometimes a foot in diameter. Common in central Michigan.
C. tomentosa L. Black or Pear Thorn.
A large shrub found in center and south of State.
C. tomentosa L., var. pyrifolia Gray. Pear Thorn.
Common.
C. tomentosa L., var. punctata Gray. Pear Thorn.
A large shrub, common.
C. Crus-galli L. Cockspur Thorn.
A dense, smooth-leaved shrub. Sometimes tried for a hedge, but the unevenness in the germination of the seeds and attacks of the borer near the ground have caused people to abandon its use for this purpose.
Amelanchier Lind.
A. Canadensis Torr. and Gray. June or Service Berry. Shad-bush.
A small tree with smooth bark, bearing small apples the size of a pea or larger. The tree flowers very early in spring; trunk quite subject to attacks of borers. Common.
A. Canadensis Torr. and Gray, var. oblongifolia T. and G.
A low shrub; common, northward.

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A. Canadensis Torr. and Gray, var. rotundifolia T. and G.
A small tree; not common.

A. alnifolia Nutt. Service-berry.
A dwarf shrub or bush, bearing mild red fruit three-eighths of an inch in diameter. Sometimes cultivated for its fruit. Pine plains and vicinity.

SAXIFRAGACEÆ—SAXIFRAGE FAMILY.

Tiarella L.

T. cordifolia L. False Mitre-wort.
A low shrub one to two feet high. Common.

Ribes L.

R. Cynosbati L. Prickly Gooseberry.
Plant and fruit prickly. It may be hybridized with the next species.

R. oxycanthoides L. Wild Swamp Gooseberry.
A straggling shrub, the parent of the Houghton and other American sorts in cultivation. Low land; common.

R. rotundifolium Michx. Wild Gooseberry.
Mostly confined to the Upper Peninsula.

R. lacustre Poir. Swamp Gooseberry.
Stems and fruit bristly. Cool places; Roscommon county and northward.

R. prostratum L'Her. Fetid Currant.
Berries red and glandular with an offensive odor. Northern Michigan.

R. floridum L. Wild Black Currant.
Low lands and along streams, common.

R. rubrum L. A shrub supposed to be of the same species as the foreign one from which our common red and white currants have been derived. Cool swamps, common northward; found as far south as Ann Arbor.

HAMAMELACEÆ—WITCH-HAZEL FAMILY.

Hamamelis L.

H. Virginiana L. Witch-Hazel.
A rather thin shrub, usually healthy; leaves yellow in autumn, not often cultivated, but deserves to be; common.

CORNACEÆ—DOGWOOD FAMILY.

Cornus L.

C. florida L. Flowering-dogwood.
A small tree of slow growth, sometimes eight to twelve inches in diameter. The large showy white bracts around the clusters of flowers make a fine display in early spring. The red berries and the red leaves in autumn add to the attractiveness. The tree is worth more attention, though it is sometimes cultivated. Montcalm county and southward; common.

C. circinata L'Her. Round-leaved Dogwood.
Ravines, common.

C. sericea L. Silky Cornel. Kinnikinnick. From Alcona county southward.

C. stolonifera Michx. Red Osier. Red Dogwood.
This is not a willow in any sense of the word, but a dogwood. Well known for its vermillion colored bark. Attractive to set in masses of ten feet or more in diameter. Low grounds; common.

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C. paniculata L'Her. Panicled Cornel.
Low lands; common.
C. alternifolia L. Alternate-leaved Cornel.
A shrub sometimes twenty feet high, branches green, streaked with white. An attractive shrub for most places. Common.

Nyssa L.

N. multiflora Wang. Pepperidge. Tupelo. Black or Sour Gum.
A tree of moderate size, and slow growth; the branches are horizontal or drooping, the smooth oval leaves red or scarlet in autumn. A very striking and attractive tree. Not often cultivated but deserves to be. Wood often very difficult to split, but sometimes splits readily. Around marshes; common as far north as Gratiot county.

CAPRIFOLIACEÆ—HONEYSUCKLE FAMILY.

Sambucus L.

S. racemosa L. (*S. pubens* Michx.) Red-berried Elder.
The common species at the north. When seen in a mass of ten to twenty or more feet in diameter and in fruit, it make a gorgeous display never to be forgotten.
S. Canadensis L. Common Elder. Sweet-elder.
When in flower a very handsome plant. Were it not for the odor of the young plants, and the fact that it spreads too freely by the roots no doubt it would be cultivated as an ornamental plant.

Viburnum L.

V. lantanoides Michx. Hobble-bush.
A shrub found in the cold swamps of the Upper Peninsula.
V. Opulus L. Bush Cranberry.
An interesting plant found in marshes, bearing a sour red fruit sometimes used for food. By cultivation we have obtained the snowball from this species.
V. acerifolium L. Maple-leaved Arrow-wood.
Two to three feet high. Dry woods in Lower Peninsula.
V. pubescens pursh. Downy Arrow-wood.
A low, straggling shrub; common.
V. dentatum L. Arrow-wood.
Five to ten feet high in wet places; worthy of use.
V. Lentago L. Sweet Viburnum. Sheep-berry.
A tree-like shrub, sometimes thirty feet high; well to cultivate in rich soil.
V. prunifolium L. Black Haw.
Perhaps in the southern part of the State.
V. cassinoides L. (*V. nudum* var. *cassinoides* Gray.) Withe-rod.
Six to ten feet high. Wet soil; common.
V. pauciflorum Pylaie. Few-flowered Arrow-wood.
A low straggling shrub. Upper Peninsula.

Linnæa Gronov.

L. borealis Gronov. Linnæa. Twin-flower.
A neat trailing shrub. Swamps; northward.

Symphoricarpus Dill.

S. occidentalis R-Br. Wolf-berry.
Northward. Rare.
S. racemosus Michx. Snowberry.
Northern Michigan; common in cultivation.

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S. racemosus Michx. var. pauciflorus Robbins.
Upper Peninsula.
S. vulgaris Michx. Coral-berry. Indian currant.
Uncertain.

Lonicera L.

L. oblongifolia Muhl. Swamp Fly-Honeysuckle.
A branching shrub two to five feet high. Rare south; common northward.
L. ciliata Muhl. Fly-Honeysuckle.
A straggling bush. Common.
L. hirsuta Eaton. Hairy Honeysuckle.
Rare south, but common northward.
L. glauca Hill (*L. parviflora* Larn.) Small Honeysuckle.
Not very common.
L. grata Ait. American woodbine.
L. involucrata Banks.
Upper Peninsula.
L. cœulea L. Mountain Fly-Honeysuckle.
Woods and bogs, northward.

Diervilla L.

D. trifida Mœnch. Bush Honeysuckle.
A low shrub. Dry banks and ravines. Common.

RUBIACEÆ—MADDER FAMILY.

Cephalanthus L.

C. occidentalis L. Button Bush.
A crooked shrub bearing spherical heads of very sweet flowers. It grows only in swamps where water is near. Common.

VACCINEACEÆ—HUCKLEBERRY FAMILY.

Plants of this family are mostly shrubs with hard wood, small seeds, difficult of propagation and not likely to survive when transplanted from their native haunts. These are some of the reasons why they are not more frequently found in cultivation.

Gaylussacia H. B. K.

G. resinosa Torr. and Gray. Black Huckleberry.
Dry open woods. Common.
G. frondosa Torr. and Gray. Blue Huckleberry.
Flint, Ypsilanti, Ann Arbor, scarce.

Vaccinium L.

V. Pennsylvanicum L. Dwarf Blueberry.
Very early in fruit; a foot or less in height; dry soil; common.
V. Canadense Kohn. Canada Blueberry.
Swamps, and on sandy plains north.
V. vacillans Solander. Low Blueberry.
Found with the two preceding.
V. corymbosum L. Swamp Blueberry.
Taller, two to eight feet; swamps, common.
V. ulginosum L.
Upper Peninsula.
V. cæspitosum Michx, var. cuneifolium Nutt. Bilberry.

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Upper Peninsula.
V. myrtiloides Hook.
Upper Peninsula.
V. ovalifolium Smith.
Upper Peninsula.
V. Vitis-Idæa L. Cowberry.
Probably in the Upper Peninsula.
V. Oxycoccus L. Small Cranberry.
Ann Arbor, Lansing, and northward. Sphagnous swamps.
V. macrocarpon Ait. American Cranberry.
Common in sphagnous swamps and bogs. Cultivated for its fruit.

Chiogenes Salisb.
C. hispidula Torr. and Gray. Creeping Snowberry.
A delicate creeping evergreen. Sphagnous swamps. Common.

Arctostaphylos Adans.
A Uva-ursi Spreng. Bear-Berry.
A very neat low evergreen. Sandy soil, northward.

Epigæa L.
E. repens L. Trailing-Arbutus. Mayflower.
A favorite evergreen, bearing early fragrant flowers. In swamps at the south, on higher land at the north.

Andromeda L.
A. polifolia L. Wild Rosemary.
A beautiful plant, with narrow glaucous revolute leaves and small pink flowers. Sphagnous swamps. Common.

Cassandra Don.
C. calyculata Don. Leather-leaf.
A shrub bearing early white bell-shaped flowers. Swamps; common.

Kalmia L.
K. agustifolia L. Sheep Laurel. Lamb-kill.
In the vicinity of Au Sable River. Low lands; common. Said by Prof. L. Agassiz to be the neatest plant that grows.
K. glauca Ait. Swamp Laurel.
A neat glaucous shrub, bearing pretty pink flowers. Northern Michigan; not very common.

Ledum L.
L. latifolium Ait. Labrador Tea.
A reclining shrub bearing white flowers. Sphagnous marshes. Northern Michigan.

OLEACEÆ—OLIVE FAMILY.

Fraxinus L.
F. Americana L. White Ash.
A fine ornamental tree; and very valuable for the timber. Southern Peninsula.
F. pubescens Lam. Red or Downy ash.
A small tree, with downy leaves and twigs. Low lands; rather common.
F. viridis Michx. Green ash.
Much like white ash. Ann Arbor, Lansing; not common.
F. quadrangulata Michx. Blue ash.
A slow growing tree bearing light-colored durable heart wood. Rich woods, not very abundant. Southward.

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F. sambucifolia Lam. Black ash.
A common tree in swamps; wood much used for hoops, furniture, etc. The tree when well grown is very beautiful and not appreciated.

SOLANACEÆ—NIGHTSHADE FAMILY.

Solanum L.
S. Dulcamara L. Bittersweet.
A shrubby plant, with slender stems, reclining on other plants for support. It bears red berries, which are poisonous. Introduced into waste places.
Lycium L.
L. vulgare Dunal. Matrimony-vine.
A slender, low shrub; sometimes cultivated.

LAURACEÆ—LAUREL FAMILY.

Sassafras Nees.
S. officinale Nees. Sassafras.
Southern Peninsula. Not abundant except as a very small tree or shrub. Often a little tender, though the leaves and fruit entitle it to a high place as an ornamental tree.
Lindera Thun.
L. Benzoin Meis. Spice-bush.
Noted for its spicy bark and twigs. Low grounds; common.

THYMELACEÆ—MEZEREUM FAMILY.

Dirca L.
D. palustris L. Leatherwood, Moose-wood.
An interesting shrub four feet high, having very tough bark and very soft light wood.

ELEAGNACEÆ—OLEASTER FAMILY.

Shepherdia Nutt.
S. Canadensis Nutt. Shepherdia.
A handsome shrub with scales on the lower side of the leaves. Dry banks about lakes.

URTICACEÆ—NETTLE FAMILY.

Ulmus L.
U. fulva Michx. Slippery Elm. Red Elm.
A thin-topped tree, with reddish, durable wood and inner bark mucilaginous. Rich woods; not abundant, less frequently seen at the north.
U. Americana L. American Elm. White Elm. Gray Elm.
This is the queen among our deciduous-leaved trees for ornamental planting. The timber varies much; if grown in open places on rather dry soil the timber is tough and suitable for wagon-hubs, and is also used after the manner of rock elm; if grown on moist soil in a dense forest the wood is soft, but valuable to cut into barrel-hoops, cheese-boxes, and cheap lumber for wheelbarrows and many other purposes. Low, rich land; common.
U. racemosa Thomas. Rock Elm. Cork Elm.

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A tall, straight tree, when well grown, of slow growth, wood tough and much used in place of hickory and white ash in constructing farm implements. The young branches are covered with ridges of cork. Low, rich land; common.

Celtis L.

C. occidentalis L. Hackberry. Nettle-tree.

When well grown, this is a beautiful tree of medium size. The wood of little use, except for fire-wood. I have received more inquiries in regard to the name of this tree than have been asked of any other. Low lands; common, at least as far as Midland.

Morus L.

M. rubra L. Red Mulberry.

A small tree, having durable wood, not abundant anywhere in the State. The leaves of young trees are lobed, but are simple on older trees. Found as far north as Lansing.

PLATANACEÆ—PLANE-TREE FAMILY.

Platanus L.

P. occidentalis L. Buttonwood. Sycamore.

The largest tree of our State; frequently hollow. The thin bark comes off in scrolls, leaving a smooth, white trunk. The reddish wood warps and checks badly, unless carefully managed while seasoning. Wood is handsome; now used in making furniture. River bottoms; common.

JUGLANDACEÆ—WALNUT FAMILY.

Juglans L.

I. cinerea L. Butternut.

A medium sized tree with a thin top. Wood soft; of a muddy brown color. River bottoms; common.

I. nigra L. Black Walnut.

Our most valuable tree for cabinet work. At one time abundant in the southern half of the Lower Peninsula; now scarce as a large tree. The top is thin; the nuts edible. The tree is often poisonous to others grown near it; as in apple orchards. Of the ten species of the world, Michigan contains six.

Carya Nutt.

C. alba Nutt. Shagbark Hickory.

Well-known for its edible nuts and tough, elastic wood.

C. sulcata Nutt. Western Shell-bark Hickory.

Much like the preceding; nuts large, yellowish. Ionia and southward.

C. microcarpa Nutt. White Hickory.

This tree bears very small nuts; has no shaggy, loose bark. Timber is much like that of the preceding species. Found with the former species.

C. tomentosa Nutt. Mocker-nut.

Reported at Flint and Grand Rapids.

C. porcina Nutt. Pignut.

Woods. Common in some localities.

C. amara Nutt. Bitternut.

Bark smooth; nuts astringent; top thin; moist soil. Common.

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MYRICACEÆ—SWEET GALE FAMILY.

Myrica L.

M. Comptonia C. DC. (*Comptonia asplenifolia* Ait.) Sweet-fern.
A very characteristic low shrub for sandy pine lands.

M. Gale L. Sweet Gale.
Swamps in portions of northern Michigan.

M. cerifera L. Bayberry. Wax-myrtle.
Reported for southern Michigan in Winchell's catalogue.

BETULACEÆ—BIRCH FAMILY.

Betula L.

B. lenta L. Black Birch. Sweet Birch.
The bark of the twigs have the taste of wintergreens. Low lands and swamps from Lenawee county northward.

B. lutea Michx. f. Yellow Birch.
A large tree with yellowish wood, now popular for furniture. Not common south of Lansing.

B. papyracea Ait. Paper Birch. Canoe Birch.
A tree on which the outer bark is white after about ten years of age. A beautiful tree for cultivation, not to be confounded with the white birch now often cultivated.

B. pumila L. Low Birch.
A slender shrub two to ten feet high. Swamps; common.

B. glandulosa Michx. Dwarf Birch.
Upper Peninsula.

Alnus L.

A. viridis DC. Green or Mountain Alder.
A quick-growing "bushy" shrub. Upper Peninsula; common.

A. incana Willd. Speckled or Tag-Alder.
A handsome small tree. Common from Lansing northward.

A serrulata Ait. Smooth Alder. Rare or local.

CUPULIFERÆ—OAK FAMILY.

Corylus L.

C. Americana Walt. Hazel-nut.
A shrub four to ten feet high, spreading freely by suckers. One of our best plants for a thicket; common.

C. rostrata Ait. Beaked Hazel-nut. Common northward.

Ostrya Micheli.

O. Virginica Willd. Iron-wood.
A small tree of very slow growth; wood very hard. Rich woods; common.

Carpinus L.

C. Caroliniana Walt. (*C. Americana* Michx.) Blue Beech.
A branching shrub, with smooth bark over a grooved stem. When grown with plenty of room, this is a very handsome shrub. Low land; common.

Quercus L.

As the oaks are so very common and some of them present such a forlorn appearance in winter when they hold the old dead leaves, they do not appear to be fully appreciated as ornamental trees for the landscape or roadside.

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Q. alba L. White Oak.
One of the most common, well known and valuable trees of the State.
Q. macrocarpa Michx. Burr-Oak.
Rich low land; common.
Q. bicolor Willd. Swamp White-Oak.
This common tree affords most excellent timber, which for many purposes surpasses that of white oak. The timber usually sells as "white oak." A rugged tree, low lands; common.
Q. prinoides Willd. Yellow Chestnut Oak.
A medium sized tree with hard durable wood. Leaves very handsome; low lands; infrequent.
Q. imbricaria Michx. Laurel or Shingle Oak.
A very attractive small tree with its entire glossy leaves. Barren land in southern part of State; not common.
Q. nigra L. Black Jack Oak.
A crooked small tree. Lansing and southwest; not common.
Q. coccinea Wang. Scarlet Oak.
A very handsome small tree; especially the small bushy specimens, as seen in autumn, on the open sandy plains in the northern part of the State.
Q. tinctoria Bartram. Black or Yellow-barked Oak.
A medium sized tree; common on dry land.
Q. rubra L. Red Oak.
A large tree, with coarse-grained, red heart-wood; low land; common.

Castanea L.
C. vulgaris Lam., var. Americana A. DC. Chestnut.
A well-known tree, valuable for its durable timber, which is also much sought for cabinet work. Tree beautiful; nuts edible; southeastern portion of our State; not common.

Fagus L.
F. ferruginea Ait. Beech.
In the Southern Peninsula one of our most common and well-known trees. Bark smooth, wood hard and of slow growth. When well grown few trees are more beautiful.

SALICACEÆ—WILLOW FAMILY.

Salix L.
Most of our willows are shrubs, and are indigenous to low lands. They are very variable and difficult to study satisfactorily.
S. candida Willd. Hoary Willow.
Rare south; common northward.
S. humulis Marshall. Prairie Willow.
Especially abundant on pine plains.
S. discolor Muhl. Glaucous Willow.
Common.
S. sericea Marshall. Silky-leaved Willow.
S. petiolaris Smith. Petioled Willow.
Common.
S. *Viminalis* L. Basket Willow.
Cultivated.
S. cordata Muhl. Heart-leaved Willow.

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"Jack Pines" on the plains, *Pinus Banksiana*

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Common.
S. glaucophylla M. S. Bebb. Glaucous Willow.
Northern Michigan.
S. balsamifera Barrett.
Once found at Flint.
S. adenophylla Hook. Tomentous Willow.
Northern Michigan.
S. rostrata Richardson. Livid Willow.
Common.
S. lucida Muhl. Shining Willow.
Common.
S. nigra Marshall. Black Willow.
A small tree. Common.
S. amygdaloides Anders.
Found at Flint.
S. *alba L.*, var. *vitellina* Cary. White Willow.
Cultivated and naturalized.
S. *fragilis L.* var. *Russelliana* Cary. Brittle Willow.
Introduced.
S. longifolia Muhl. Long-leaved Willow.
Common.
S. myrtilloides L. Myrtle Willow.
Common.

Populus L.
P. tremuloides Michx. American Aspen.
A small, well known and common tree; wood used for making paper.
P. grandidentata Michx. Large-toothed Aspen.
A small tree of Southern Peninsula; wood used in making paper.
P. monilifera Ait. Cottonwood.
A large tree of rapid growth found in the central and southern parts of State.
P. heterophylla L. Downy Poplar.
St. Joseph county and southward.
P. balsamifera L. Balsam Poplar.
A small tree of rapid growth. Common.
P. balsamifera L., var. candicans Gray. Balm of Gilead.
Rare, wild; not uncommon in cultivation.

EMPETRACEÆ—CROWBERRY FAMILY.

Empetrum.
E. nigrum L. Black crowberry.
Upper Peninsula.

CONIFERÆ—PINE FAMILY.

Thuya L.
T. occidentalis L. Arbor Vitæ. White Cedar.
Very common in swamps north of the central part of the State; useful for posts and telegraph poles and for ornamental planting.

Juniperus L.
J. communis L. Juniper.
A spreading shrub about lakes and bluffs; common.
J. Sabina L., var. procumbens Ph. Savin.

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Trailing over sand-dunes and in some other places of the north.

J. Virginiana L. Red Cedar.

About lakes and along streams; not abundant. This is, perhaps, the most widely distributed of any tree in North America. Wood red, durable, fragrant. Tree beautiful in summer, but becoming dingy in winter.

Taxus L.

T. Canadensis Willd. Ground Hemlock. American Yew.

A trailing shrub; along streams and under trees; northward. Common.

Pinus L.

P. Strobus L. White Pine.

The leading pine tree of the State for lumber; useful for planting in a park or large grounds. Lansing, northward.

P. resinosa Ait. Red or Norway Pine.

A slim, long-leaved pine much valued for its timber. The tree is superior to Austrian pine for planting, but not often employed, as the seeds are not easy to obtain. Sandy land; Isabella county, and northward.

P. Banksiana Lambert. Jack, Gray, or Scrub Pine.

A resinous, soft-wooded tree of little use. Sandy soil, from northern Indiana, along Lake Michigan; very common on the light sand at the north.

Picea Link.

P. nigra Link. Black Spruce.

A small tree of slow growth in swamps; wood used for making paper. Ingham county and northward; common.

P. alba Link. White Spruce.

Along the Au Sable and westward, Upper Peninsula.

Tsuga Endl.

T. Canadensis Carriere. Hemlock.

The handsomest evergreen in cultivation. A large tree, making rather coarse lumber. Eaton county and northward.

Abies L.

A. balsamea Miller. Balsam Fir.

Common in swamps from Clare county northward. Beautiful; in cultivation for about fifteen years. Wood used for making paper.

Larix L.

L. Americana Michx. Tamarack. Am. Larch.

A tall slender tree, swamps, common.

SMILACEÆ, SMILAX FAMILY.

Smilax L.

S. rotundifolia L. Common Greenbrier.

A prickly vine sometimes fifteen to twenty feet long climbing by tendrils at the base of the leaves. This and the next are the only endogenous woody plants native of our State. There may be some uncertainty about the identification of this species.

S. hispida Muhl. Common Greenbrier.

Much like the former; common.

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"Yellow Jack Pines." Tall trees of slow growth, *Pinus Banksiana*.

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TREES AND SHRUBS OF MICHIGAN COMPARED WITH THOSE OF THE REST OF THE WORLD.

[BY W. J. B.]

Michigan is very rich in trees and shrubs. If I have counted correctly there are 70 species of indigenous trees and three exotics have escaped from cultivation; 150 native shrubs, 5 exotics have spread from cultivation. This gives us 220 indigenous woody plants and 8 exotics which have become naturalized.

To comprehend the relative importance of our trees and shrubs, let us glance at the forests of Great Britain. Great Britain and Ireland contain 121,260 square miles of land, Michigan 60,000, a little less than one-half as much as Great Britain. She has one species of basswood not so good as ours; one maple not over twenty feet high; one cherry from ten to twenty feet high; one small ash, two elms, two poplars, one beech, which grows very large but not very high; one small white birch, one species of pine, by no means a match for our white pine; a species of oak which sometimes grows to a great size.

Great Britain has about ten species of trees native of her soil. Michigan, with half the territory, has seventy species (ninety if we compare the sizes exactly), nine times as great a variety. Great Britian has no whitewood, no white or red cedar, no walnuts or hickories. Michigan has six species of maple of tree size, a basswood, a whitewood, honey locust, Kentucky coffee tree, two cherries, a pepperidge, five species of ash, a sassafras, three elms, a hackberry, a mulberry, a buttonwood, black walnut, butternut, six hickories, about twelve oaks, a chestnut, a beech, four tree birches, four willows of tree size, six poplars, three pines, four spruces, one larch, one arbor vitæ and a red cedar.

The forests of north America may be divided into two regions, the Atlantic and the Pacific. In the Atlantic region there are 292 species, in the Pacific region 153 species.

In all Europe there are only 85 species of trees.

WHY HAS MICHIGAN SO MANY AND GREAT BRITAIN SO FEW?

[BY W. J. B.]

This question now very naturally arises: Why has the Atlantic region, including Michigan, so many species of trees and why has Europe so few? Certainly we cannot attribute this difference to a defective soil and climate of Europe, as they now exist, for Europe can grow all sorts of trees now found in the temperate zone, while "Great Britian alone can grow double or treble the number of trees that the Atlantic States can."

The former geological conditions of their continents help to explain all this difference in the distribution of trees to the entire satisfaction of scientists.

Away back in the Tertiary Period the trees of the regions now possessing an arctic climate were such as now thrive in a warm temperate zone like that of Georgia and California. This is well illustrated by the abundant fossil remains of trees. Following this, came a long time when extreme cold

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prevailed, known as the Glacial Epoch, when snow and ice for most or all of the year extended to the Ohio river. At the approach of cold, the trees slowly retreated southward, as generation followed generation. The plants such as now thrive in southern Michigan, perhaps then extended to what now forms the State of Alabama, while the arctic plants reached Ohio.

As the climate again gradually grew warmer, the trees and other plants slowly migrated northward. Some arctic plants were stranded on the White mountains and in Labrador, where they still remain; others went farther north.

Plants of the cool temperate zone reached Michigan. In a similar manner, during the Glacial Epoch the plants of Europe were driven southward. The Alps, the Pyrenees, the Appenines, the Caucasus, still contain some of these arctic plants which retreated there at the close of the Glacial Epoch. Most of the plants of the warm temperate region had perished and therefore were unable to retreat when the continent became warmer.

I quote the words of Dr. A. Gray, from whom other hints are taken, as found in the American Journal of Science, page 194, 1878. "I conceive that three things have conspired to this loss First, Europe hardly extending south of latitude 40°, is all within the limits generally assigned to severe glacial action. Second, its mountains trend east and west, from the Pyrenees to the Carpathians and the Caucasus beyond, near its southern border; and they had glaciers of their own, which must have begun operations, and poured down the northward flanks, while the plains were still covered with forest on the retreat from the great ice wave coming from the north. Attacked both on front and rear, much of the forest must have perished then and there. Third, across the line of retreat of those which may have flanked the mountain ranges, or were stationed south of them, stretched the Mediterranean, an impassible barrier."

"Greenland may be referred to, by way of comparison, as a country which, having undergone extreme glaciation, bears the marks of it in the extreme poverty of its flora, and in the absence of the plants to which its southern portion, extending six degrees below the arctic circle, might be entitled. It ought to have trees, and might support them. But since destruction by glaciation, no way has been open for their return."

"In the American continent the mountains run north and south. The trees, when touched on the north by the on-coming refrigeration, had only to move their southern border southward, along an open way, and there was no impediment to their due return. So our lines have been cast in pleasant places, and the goodly heritage of forest trees is one of the consequences."

QUESTIONS SENT TO SUPERVISORS AND THEIR REPLIES.

Before proceeding further, it will be well for the reader to consult page 70, where he can make himself familiar with the law which required the commission to send lists of questions to the supervisors.

It will be seen that sections four and five provide for collection of information from supervisors as to forest areas, forest fires, etc. Whether, in the opinion of the directors, there was a prospect that much or little valuable information concerning forestry could be gathered from answers to questions sent to supervisors, they saw but one course to pursue, viz., to send the questions. These sections were our only guide in the matter, and, in accordance

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with this law, copies of the questions which appear below were prepared and in March sent by express to the county clerks, with request to place them in the hands of the supervisors after their election in April.

The questions were only furnished to those supervisors living in the country, 1,185 in number. There seemed no use in sending to those living in wards of cities.

COPIES OF QUESTIONS SENT TO SUPERVISORS.

1. How many acres of forest land in your township? .....
2. " " " " " " heavily timbered? .....
3. " " " " " thin or cut over? .....
4. How many acres of barren or hilly land might be better covered with forest growth? .....
5. How many acres of forest land were burned over in 1887?
6. Estimate the amount of damage done by such fires to:
   a. cordwood and stovewood, ...
   b. logs, bolts and staves, ...
   c. tanbark, ...
   d. fencing, ...
   e. lumber, ...
   f. bridges, ...
   g. buildings, ...
   h. timber (standing or uncut), ...
   Total loss by fire, ...
7. How did the fires originate? State the number from each cause. .....
8. What methods are found most effective in preventing and checking fires?
9. Does your township, in your opinion, need any forestry legislation? If so, in what directions? .....

At the time of writing this only 722 reports have been received, from the 1,185 lists sent out. Many of these are so incomplete that there seems to be nothing gained by printing the meager statistics furnished. A few reports were complete, but many seemed to consider themselves under no obligation to answer the questions. The following brief notes appear to be about all that can be gathered from the reports which have reached us:

About 488 saw no need for forestry legislation, while 105 made no reply to this question; 128 would like legislation in some form. Of this number 40 want protection from fires; 6 would exempt timber lands from taxation; 10 would have laws to prevent wastefulness by lumbermen; 36 would have laws enforced regarding highway tree planting, while 37 would, by various measures, encourage tree planting for several purposes. By counties the sentiment is as follows:

Alcona.—Four reports, all asking for legislation against fines.

Alger.—Three reports. One says there is no need for law in this direction, and one wants something to protect from locomotives.

Allegan.—Sixteen reports. Eight want no more laws or officials, as the State and county taxes are too high now. Four would like a law to enforce tree-planting on highways.

Alpena.—Four reports. "Give us a law that will fine heavily those persons setting fires in unsafe places from June first to September fifteenth."

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Antrim.—Seven reports. Four want no more laws on this subject, while one wants a law that will kill off speculators and send in actual settlers; and another, anything that will stop non-residents from despoiling so much timber land long before it is wanted for cultivation, and furnishing starters for forest fires.

Arenac.—Four reports. Three are opposed to laws on this subject, but ne wants protection from carless hunters and lumbermen while camping.

Baraga.—One report. No.

Barry.—Nine reports. Six of whom ask for no more law—too much now.

Bay.—Eight reports. No more law.

Benzie.—Six reports. Four say "no," decidedly to the question of legislation. One would make speculators and "land kings" responsible for damage done by fires running from their lands.

Berrien.—Sixteen reports. Ten want no law on the matter, and three would like to see trees planted along the highways, the bluffs covered, and no fallen timber allowed to go to waste.

Branch.—Ten reports, of which seven are negative on the question of law. One says, "We are legislated now till we stand in daily fear of death from tax consumption."

Calhoun.—Twelve reports, all negative.

Cass.—Six reports, all negative.

Charlevoix.—Twelve reports. Nine want no legislation, except to prevent being taxed to death while clearing their land. Report fires as originating from clearings and from railroads, but as doing no particular damage.

Cheboygan.—Five reports, asking the manufacturer to come, to dispose of their surplus timber.

Chippewa.—Three reports. Two want protection from fire, and one does not.

Clare.—Six reports. Three would have pine stump lands protected from fire, and careless persons heavily fined for damage they may have caused by fires. Fires reported as mostly originating from hunters setting, or from clearings.

Clinton.—Fourteen reports. Eleven want no forestry legislation, while two think laws ought to be made requiring tree planting on roadways and hillsides.

Crawford.—Nine reports. Five see no need of laws except upon the matter of forest fires. Four would plant trees on waysides and protect the plains from fires. All report fires as mostly originating from woodmen, river drivers, and sportsmen.

Delta.—Five reports. Two are opposed to law in the matter, while two would like to see the stump lands reset, perhaps by the State. They report fires as originating from locomotives.

Eaton.—Ten reports, and eight negatives. Two would like something that would induce farmers to save more timber, and to stop the draining of tamarack and ash swamps.

Emmet.—Nine reports. "Nothing can be done by legislation." "Farmers will take care of themselves." Report fires mostly originating in clearings.

Genesee.—Seventeen reports. Twelve are opposed to any law in this direction, while three would like a law compelling land owners to plant along streams, boundary lines and highways.

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Gladwin.—Five reports. Nothing wanted except to get rid of the forests. "Too much on hand."

Gogebic.—Two reports. Both want no laws on the matter. Hunters a great cause of fire.

Grand Traverse.—One report. "Make each highway overseer an officer of State fire department with power to call out help and forbid setting fires during dry periods."

Gratiot.—Eight reports. "Farmers can take care of themeelves without any forestry assistance." All say "no."

Hillsdale.—Eleven reports. Seven want nothing in the shape of forestry laws, but three would like anything that would induce land owners to plant trees for protection from winds, etc.

Houghton.—Four reports. The sentiment is, "Of what use is law when large private interests can not protect from fires."

Huron.—Twenty-two reports. Eleven want laws that will induce or compel farmers and land owners to plant and care for wind-breaks, to plant trees along line fences and roadsides, and to prevent the useless destruction of timber on lands unfit for agricultural purposes. Nine want no laws and say the fires have mostly been caused by carelessness in burning fallows.

Ingham.—Seven reports. The feeling is, that fires are of no account, and that no legislation is needed.

Ionia.—Eleven reports. Nine are opposed to legislation, but one favors a law enforcing tree planting along roadsides.

Iosco.—Six reports. All "no." One wants experimental plats set by the State to determine what trees are best for setting on the barrens.

Iron.—Three reports. "No laws wanted."

Isabella.—Nine reports. Seven opposed to legislation, and two have nothing to say.

Jackson.—Ten reports. Eight see no need of it, but two would have laws prohibiting unnecessary cutting of timber from poor lands and hillsides.

Kalamazoo.—Eleven reports. Three would like laws made and enforced so as to secure tree planting along rivers, highways and on waste lands. Six think farmers can take better care of the timber than State laws would. Fires of no account.

Kalkaska.—Seven reports. Three wish for no forestry legislation, while three would have the State or United States plant the plains with pines and protect them. These want trees planted along the roadside. Fires mostly originate from camps and clearings.

Kent.—Ten reports. Solid against more law.

Keweenaw.—Two reports. No legislation needed.

Lake.—Ten reports. Five want legislation to prevent wasteful cutting of timber, to prevent forest fires, and to regulate the use of fire when clearing. Most fires originate from burning fallows. Three think we have too much law already.

Lapeer.—Eleven reports. Four want no legislation on the matter, but three think it would be wise to make every man plant yearly along the highway a certain number of trees, the number varying with the assessed valuation, and that all timber plats should be exempt from taxation.

Leelanaw.—Eight reports. Fires mostly caused by careless boys and sportsmen. Five see no use of law in this direction, while one wants a law that

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will create a market for timber. One wants a law to compel land owners to plant timber.

Lenawee.—Seventeen reports. Eleven see no need for legislation. One thinks Congress should take the tariff from lumber. One thinks ten per cent of the land, if in forest, ought to be exempt from taxation. One thinks windbreaks and other planting should be encouraged by premium. Fires no item.

Livingston.—Six reports. Unanimously in favor of no legislation.

Luce.—Yes, clear and make roads.

Mackinac.—Four reports. Two are silent on the matter of laws, and the other two saw no need of laws for forestry.

Macomb.—Thirteen reports. Ten report as unfavorable to forestry legislation at present, but think it may be needed in the future. No fires.

Manistee.—Eleven reports. Eight think forestry legislation is not needed. Three would like to see laws to enforce the planting of trees on land cut over, the care of those already growing on such lands, and the protection of all from from fires.

Manitou.—Three reports. Two "no," and one thinks the present laws ought to be enforced.

Marquette.—Three reports. No laws needed.

Mason.—Ten reports. Six say "no," while three think something should be done to stop forest fires, encourage tree planting, on highways and farm boundaries, and to induce farmers to preserve good wood lots.

Mecosta.—Eleven reports. Nine see no use for forestry laws. One would like laws encouraging forest planting. Locomotives and careless hunters about equally responsible for fires.

Menominee.—Two reports. "No."

Midland.—Ten reports. Five see no need of forestry legislation. One wants laws *compelling* the setting of trees along the highway. Fires caused about equally by berry pickers and tramps.

Missaukee.—Eight reports. Three would have no more laws. Two would do something to prevent destruction of timber and leaving rubbish heaps. Fires mostly from logging railroads.

Monroe.—Ten reports. All negative.

Montcalm.—Thirteen reports. Seven see no need of more laws. Five think there should be more laws and better enforcement of those we already have. "The State should own all land not suited to agriculture and keep it in forest." Hunters and railroads about equally responsible for fires. One says there should be laws to compel the planting of roadsides.

Montmorency.—Five reports. Three want no more laws, while two think the United States government should plant and re-forest the plains. Fires originate from camps and fishers.

Muskegon.—Nine reports. Six say "no" to the question of forestry laws, while two would cover the sand dunes if possible, and have a fire warden to look after the fires during dry times. Railroads and fallows equally responsible for fires.

Newaygo.—Fourteen reports. Eight care for no more law. Three would like to see the barrens covered with trees, and have something done for the pine stump lands. Fires caused mostly by locomotives on logging railroads, and by careless fishermen.

Oakland.—Sixteen reports. Eleven believe the forest owner should

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lookout for himself. Three would have timber land exempt from taxation, and would like to see trees planted along roads and upon hillsides and waste places.

Oceana.—Ten reports. Six think laws would do no good. Three think it would be well to be obliged to secure permission from fire warden before setting fires in a dry time. Most all fires caused by fallows.

Ogemaw.—Thirteen reports. Nine say legislation for their section is needless, but three would like to see laws looking toward the covering of the barrens with forest growth. One would offer a premium on forest destruction. Locomotives and fallows the two sources of fires.

Ontonagon.—Five reports. No fires reported. All say "no" to forestry legislation, and one says that for his township it would be a "humbug."

Osceola.—Nine reports. Six think legislation is not wanted now, three think that the young growth on certain sections should be protected from running fires.

Oscoda.—Seven reports; three think fire laws should be enacted, and that the State should see that the so called "barrens" should be reset and protected. Four see no way to legislate to advantage, and one wants more settlers to clear up the land.

Otsego.—Five reports. Fires originate with hunters and those clearing land, but all are emphatically opposed to laws on the matter.

Ottawa.—Eleven reports. Eight are opposed, while three think that some laws might be enacted which would preserve our forest to the extent of ten per cent at least. They report fires as caused mostly by burning fallows.

Presque Isle.—Seven reports. Three see no need for forestry laws, while one thinks something to prevent forest fires would be very beneficial. Three others did not answer.

Roscommon.—Four reports. Three ask for no more laws. One, a law to induce replanting.

Saginaw.—Twenty-four reports. Sixteen are negative. Four are in favor of any legislation that will encourage tree planting on roadsides and barren lands, and to compel the use of spark arresters on locomotives.

Sanilac.—Thirteen reports. Five would like to see some law that would oblige the wayside planting, and protection of trees on strips eighty rods wide along the shore of Lake Huron, and the keeping of cattle off the roads. Fires caused mostly from the clearing of land.

Schoolcraft.—Two reports, both negative. Fires caused by hunters.

Shiawassee.—Seven reports, all negative answers. No fires in the county for years.

St. Clair.—Eight reports. Five think there is no use for more laws, while one thinks roadside planting ought to be encouraged.

St. Joseph.—Fourteen reports. Thirteen say they have had too much legislation, while one thinks there ought to be a law to protect what timber is left.

Tuscola.—Fifteen reports. Eight say no legislation is needed, but three favor the appointment of five wardens to regulate the setting of fires during dry times. Usually fires originated in burning fallows.

Van Buren.—Fourteen reports. Ten see no need of laws upon the matter, while three feel that something should be done to induce tree planting along the roadsides and upon waste lands.

Washtenaw.—Eleven reports. Eight say "no," as farmers are already

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setting trees along roads and for windbreaks. One is in favor of exempting timber land from taxation.

Wayne.—Eleven reports. All agree in saying that they are in no wise interested in forestry legislation. Land is too valuable to raise timber.

Wexford.—Eleven reports. Seven want no more legislation. One wants legislation to assist in removing forests. One thinks some law should prevent the burning of fallows during dry periods without permit from some authorized person. They report fires caused by careless hunters and fishermen, and from burning fallows.

REPLIES FROM MEN IN THE SOUTHERN COUNTIES IN ANSWER TO QUESTIONS SENT THEM.

List of Questions.

The following list of questions was sent to residents of some of the southern counties of the State:

1. Give instances from your experience or observation of any climatic changes due, as you suppose, to deforestation in your section.
2. Name the changes, if any, in farm, garden, or orchard crops that have resulted from deforestation.
3. Give data of influence of deforestation on the flow of springs, brooks, and rivers.
4. What is the per cent. of timber land in your section? Heavy or light?
5. Is it a common practice to pasture timber lots in your locality? with what results?
6. Is reforestation desirable in your section?
7. What legislation would you advise to increase or improve forest area? That is if such were needed.

The following answers were received to the above questions. They are arranged in alphabetical order.

FROM PROF. A. J. COOK, AGRICULTURAL COLLEGE, MICH.

1. When a boy, we raised peaches with no trouble at Bennington, Shiawassee county. Now the trees die in winter. Then my father kept bees with almost no loss. Now bees die badly. I have supposed this colder climate is due to removal of forests. I think it is.
2. Peaches and more tender apples, once hardy, are not able to resist the recent hard winters. Winter-killing of wheat and clover is also more pronounced in recent years, I think.
3. If the springs, brooks and rivers have changed I have not noticed it. I have fine springs on my farm, and they are flush as ever, I think, though I am not in position to be positive.
4. I think in my township about 15 per cent. is forest and consists of heavy timber.
6. I hardly think so, as yet, further than roadside planting.
7. I think of no way except by tax reduction or otherwise to induce people to leave timber now standing, or at least a good portion of it, and to stimulate tree planting along roadsides.

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FROM EUGENE DAVENPORT, WOODLAND, MICH.

Dr. W. J. Beal, Agr'l College,—Dear Sir:

1. There is a belief that we have more frequent and severe winds than when the country was newer, especially in the fall, winter and spring seasons. That we are less subject to late spring and early fall frosts seems almost certain. When the clearings were small and isolated, they were of the nature of hollows in the great wooded area, where cold air settled and rested. This condition is changed and the air is now usually in motion.

For some reason or other what is known with us as the *maple sugar season* is gradually shortening. Formerly there was a gradual warming up of things as winter merged into spring. In later years we have more sudden changes, with a greater range of temperature, but they are comparatively few in number and the whole thing is soon over.

2. I have no accurate data on this question.

3. All the springs in this vicinity have been lately opened, but the only brook I know here runs much lower than formerly.

4. Between fifteen and twenty per cent.

5. It is common to pasture timber lots; sheep, if on short pasture, will destroy the seedling trees; I have not noticed that cattle do, but their "range" has been large, wherever I have observed.

6. I do not believe that reforestation in the sense of increasing the area is desirable, but in the sense of improving and preserving our timber lots, and in planting open places, waste places and borders, I think it is. Something ought to be done to preserve the young growth of valuable trees springing up in our wooded lots. Our forest area is *large* enough, but not *good* enough. If roadsides, lanes and permanent fences were lined with trees they would do much to temper the biting winds of winter and the heat of summer.

7. I cannot see what legislation can do, either by awards or penalties, to induce owners to care for their timber lot. Perhaps it might induce roadside planting to some degree. If the roadsides could be declared public property, condemned so to speak, public officers take the matter in charge, actually plant the trees and care for them, something might be done. Some such plan as this might be successful, but I cannot believe that legislation alone will ever take hold of the individual owner and cause him to move in this matter.

FROM A. C. GLIDDEN, PAW PAW, MICHIGAN.

W. J. Beal,—My Dear Sir:

Your letter of inquiry relating to forestry questions is before me. I am really sorry that I cannot be in entire sympathy with you in this matter, which you doubtless have so much at heart. I don't believe the facts you will gather will be worth their cost.

I will concede, for the sake of the argument, that deforestation has let down the forces of the upper air current 100 feet or so, and that it is five degrees colder for want of forest protection. This will answer the first question. The results are that we do not have peaches as regularly every year as we did twenty-five years ago. This answers the second question. Suppose this assumption to be conceded, of what practical value is it to the state unless you can find a remedy? Reforesting a large area is such a preposterous project that you would not wish to father it, I know.

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In answer to the fourth question I may say that there are but twenty-four acres of timber upon the section of land on which my farm is situated. This is mostly young, but I do not believe you could add ten acres to this amount, with the consent of the owners, by any sort of encouragement given by legislation. The land is worth more for other purposes, and we will stand the five degrees of cold and be the gainers.

There are some lands along Paw Paw river in my township—Antwerp—too poor for general farm purposes, that might, perhaps, to advantage be planted to white pine. But I believe it is worth more for sheep range than for this. There is not, in my opinion, one chance in one hundred to effect anything in the direction you have outlined on any of the older settled farm lands of the State.

FROM A. A. LUCE, GILEAD, MICHIGAN.

Prof. W. J. Beal,—Dear Sir:

In answer to your questions I will answer to the best of my ability as follows:

1. Sudden changes come more frequently than formerly in winter. These and the extreme drouths of the past ten years or more are, in my opinion, the effect of deforestation.
2. These drouths affect crops of every kind, but especially corn, grass, and garden crops.
3. One stream that formerly furnished power to run a saw-mill four or five months during the year, now has water only in the spring months. Another that supported a mill every three miles is now almost dry during the summer months.
4. About four per cent heavy and six per cent light timber.
5. Yes. It kills the timber.
6. Yes.
7. Lessen the taxes by giving premiums upon forest planting.

FROM T. T. LYON, SOUTH HAVEN, MICH., PRESIDENT MICH. HORT. SOCIETY.

Dr. J. W. Beal,—Dear Sir:

In reply to your questions respecting my experience and observation in forestry matters, I will state that from 1828 to 1874—a period of forty-six years—they were had at Plymouth, Wayne county. Since the latter date I have resided at South Haven, Van Buren county. The chief facts that have come under my observation must, therefore, pertain to the former place.

1. In 1828 the whole interior of Michigan was a dense forest. Plymouth was first settled in 1825. Down to about 1854, peaches had been a certain crop. Such a circumstance as the winter-killing of peach buds had been unknown, or at least unobserved. Since about that period, not only have the fruit buds been winterkilled at least three years out of five—evincing the fact that as the forests disappeared, temperatures reached lower extremes—till, for twenty or more years past, not the fruit buds only, but even the peach trees are frequently killed outright by severe winters. In 1848 to 1852, I planted extensive orchards at Plymouth, among which were a large number of the Heart and Bigarreau cherries, which are well known to lack hardiness in this climate. These were planted on the easterly side of a strip of dense

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timber, where they remained wholly uninjured, till the strip of timber was cut away, giving the westerly winds an unbroken sweep of from two to five miles over cultivated lands; with the result that very many of the cherry trees were winter-killed or badly injured within the next few years.

2. As already stated, peaches have become a very uncertain crop, and have practically gone out of cultivation. Apples, at the first settlement of the country, never were known to be injured by the cold of winter; now only very hardy varieties are exempt. Wheat was for many years a staple and profitable crop. More recently, among other difficulties, it is occasionally bare of snow, when it is usually winter-killed.

3. The river Rouge, passing through the town of Plymouth, takes its rise in the next town west, Salem. Originally it was copious enough to afford power to operate six saw-mills, and four grist or flouring mills. At present only three saw-mills are supplied with power and during but a part of the season, while two grist mills remain, and at least one of these is supplemented by a steam engine. Many springs have either wholly disappeared or only afford water during wet weather.

4. The percentage of timber now remaining can only be accurately arrived at by an actual census. In the absence of this I estimate the amount at probably ten per cent.; which is quite possibly excessive.

5. I think timbered lands are pastured in the majority of cases, with the result that waste and decay are not being replaced with new growths; so that, with the continuance of this practice, the land will become deforested with the maturity of the present growth of timber.

6. There has for several years been a dearth of timber in the town; and reforestation is already felt by many persons to be a pressing need. Very little has, however, been done in this direction.

7. I would encourage the preservation or replanting of timber by exempting from taxation a strip, six rods wide, along the west or north sides of each eighty acres, when saved from the original forest or densely replanted, and preserved against fires and the browsing of stock.

Also make it a penal offense to set, either intentionally or accidentally, fires which shall damage adjacent property.

Also exempt from taxation, say for the first six or more years, any and all lands planted for the purpose of growing timber, specifying varieties to be planted, distances apart, and treatment to be required—also requiring the exclusion of farm stock.

Require, under sufficient penalty, that persons, whether farmers or lumbermen, in cutting timber, leave the debris, is the best possible condition to prevent the spread of fire.

Require all railroad companies to take effective measures, by the use of spark-arresters as well as by a vigilant police, in case of dry or windy weather, to prevent the setting and spread of fires along their tracks.

FROM GEO. D. MOORE, MEDINA, MICHIGAN.

1. The tendency seems to be for winter weather to continue later into the spring months, and for autumn weather to continue much later than formerly.

2. Orchard crops are much less certain, as well as wheat and clover.

3. I cannot give definite dates, but know of several brooks and springs that used to flow for the entire year that are now dry a good portion of the time.

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4. About fifteen per cent. Heavy timber.

5. It is the general practice to pasture wood lots. Much of the large timber is dying and there is but little undergrowth.

6. I think not more than the planting of belts for windbreaks.

7. I think it would be difficult in this country, even though in some cases benefits might arise by limited reforestation.

FROM W. K. SEXTON, HOWELL, MICH.

Prof. W. J. Beal,—Dear Sir:

Replying to your circular letter on deforestation, I will say:

1. Deforestation is causing drouth, less rainfall and heavier and more frequent winds. Severe winters are more frequent than formerly.

2. Deforestation has cauzed more frequent freezing of winter wheat and almost an entire failure of the peach crop.

3. Deforestation has caused the failure of many springs and shallow wells, necessitating deeper digging for water. This may be considered to a great extent an advantage.

4. About ten per cent; mostly light.

5. It is customary to pasture timber lots. I consider it no injury to the trees and but little benefit to the stock, except in the way of shade. I think stock should be provided with shade in every field. I have known stock to be afflicted with sunstroke.

6. Reforestation in this locality is not of great necessity yet, but the saving of trees in wasted places, in fields for shade and roadside planting should be encouraged.

7. I would favor the effectual carrying out of the present law in regard to planting trees by the roadside, but would not favor legislation that should tax the people for reforestation.

FROM PROF. V. M. SPALDING, ANN ARBOR, MICH.

1. I am not aware of any climatic changes in this section that have resulted from deforestation.

2. No changes in farm, garden or orchard crops have resulted here from deforestation *as far as my own observation goes.*

3. *None* have come under my *direct observation.* There are abundant examples of such changes, however, that are perfectly well attested. Our tamarack swamps become much more dry when the trees are cut off.

4. I have not the data for answering fully. This region is largely "oak openings," but on different kinds of soil in the townships adjacent to Ann Arbor heavy timber, including, maple elm, ash, whitewood, basswood, oak, hickory, etc., occurs.

5. Pasturing timber lots has been practiced to a considerable extent in this township. The results have not been manifestly injurious.

6. There is no reason for supposing that if the poor land that is badly tilled were reforested it would be a profitable investment of capital and enhance greatly the value of the farms on which it might be undertaken.

7. I do not yet feel settled as to the best form of legislation. I regard the establishment of a Forestry Commission an important step. If this commission is given full opportunity for making the necessary observations and

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these are widely published, the great body of information thus disseminated will aid greatly in creating a proper public sentiment, and in inducing corporations and individual proprietors to preserve existing timber growths and to encourage planting.

Some steps ought by all means to be taken towards establishing a few experimental stations, in an inexpensive way, in this and two or three other localities in the State, in order to determine by direct experiment what may be expected of different species of trees under different conditions.

I regret that I am unable to answer as fully as is desirable, but am forced to write in this incomplete way or else defer an answer an indefinite time.

FROM B. W. STEERE, ADRIAN, MICHIGAN.

1. Heavy and destructive winds more frequent and severe. Drouths more frequent and of longer continuance. Heat of summer and cold of winter often more intense. Another change I have been watching is that in the *direction* of our winter winds. We always used to look for and expect southwest winds in the coldest weather. As late as the "cold New year" of 1864 the wind was southwest by south, blowing the snow almost horizontally for days, with the cold intense. Now, as in many other States, the coldest weather accompanies a west or northwest wind. A corresponding change seems to have taken place in the opposite undercurrents that often precede a storm, which instead of being east or northeast are now often from southeast. I do not pretend to account for all this by *local* deforestation, but may not the destruction of extensive pine forests, far to the west, northwest, or north, have had something to do with it?

2. Portions of our country are so open that wheat and clover are sometimes nearly ruined by the snow being blown from the fields, except perhaps on the west side, where fences and roadside trees caused drifts and partial protection. In such windy localities many fruit trees lean toward the northeast, owing to southwest winds in the growing season. The upper or southwest side is pretty sure to become diseased. May not the greater heat and cold of recent years, alluded to above, be credited with much of the present unhealthy condition of some of our orchards? Perhaps high winds are becoming more common in autumn, also, like that of October, 1886, when so many of the finest apples and late pears were dashed to the ground, and those of the more delicate kinds, like Bellflower, remaining on the trees were so battered by each other and adjacent limbs as to be nearly worthless.

3. More wells have had to be deepened in the last four or five years than in all the years preceding. It is well known that springs dry up where the timber is destroyed, and, as a matter of course, brooks and rivers suffer also.

4. I cannot give the per cent., as in some of the older portions scarcely any of the timber is left, while newer parts may still have from two to ten, and a few as high as twenty or more acres to the farm. Timber mostly heavy.

5. It is common to pasture timber lots. Where the timber has been thinned enough for the blue grass to come in, it suffers more or less, depening somewhat on kinds, perhaps beech the most.

6. However desirable it might be, it is impossible when a man values a bushel of wheat or corn above the most beautiful tree.

7. I suppose the only legislation practicable at present, would be in

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reference to roadside planting, as continuous rows of trees on both sides of all highways would be a great protection, and perhaps ameliorate the climate somewhat, with but little loss of land. Therefore, I would recommend a very stringent law, with heavy penalties, requiring all land owners to plant such rows, within a given time, the trees to be not less than thirty feet nor more than sixty feet apart; with a fine of $25 for failure to plant, and $10 for each tree cut down, whether transplanted or native, provided the space left between the remaining trees is more than sixty feet; this explains the reason for fixing the minimum at thirty feet, as every alternate tree could finally be cut down without violating the law. It should be made the duty of the overseer of highways, or some other officer, to notify all land owners of the law within a given time of his election, also to prosecute, collect fines, etc., in *every* case of violation; himself to be fined, not less than twenty nor more than fifty dollars for each failure of duty,—the money in both cases to go to benefit the district. The osage orange hedge, in addition to its ragged and unsightly appearance, and its many other objectionable features, is of late also contending for the right of way with our fine old shade trees; and the farmers, finding it does not flourish under them, are cutting them down. It is a sad fact that, for this cause and quite a common lack of a proper appreciation of the use and beauty of the trees, hundreds are being annually destroyed, and if not soon checked the very neighborhoods most needing them will be destitute.

Dear sir, you can see by what has been said above, that the present law regarding highway planting is inoperative with us. Some of the causse appear in my reply to question seven, but the most potent is that, for good reasons, neighbors will not complain of nor prosecute one another. So it becomes a *positive necessity* to make it the *duty* of some one, under *heavy* penalty, in which case he will not incur the dislike of friends.

Perhaps a higher officer than I indicated, as road commissioner or even one for the whole country, to have a general oversight, also to know to a certainty that those below him do their duty.

Another cause of failure is the prevailing ignorance of the existence of our present law. I discovered this in efforts to save certain fine old trees, some of which stand to-day, one partly cut down. One quite intelligent man was surprised to find that he might not cut trees on land for which he had paid; but being a good christian he abstained from breaking the law. I think he is glad now that he did and that he loves those grand old natives the better for it.

Some such highway law as indicated need not, and I think would not interefere with reforestation where most needed, as in the thin soils of the pine districts. Such a law, if strictly enforced, would be likely to have an educating influence; the value and beauty of trees would become a more common topic of conversation; and in time men would as soon think of killing their best cow for the hide as cutting some grand old oak, in a conspicuous position, for a few posts or a little firewood, of which I have known a number of instances.

Should not the Agricultural College and State Horticultural society take up the osage hedge nuisance?

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REPLIES FROM MEN IN THE NORTHERN COUNTIES IN ANSWER TO QUESTIONS SENT THEM.

List of Questions.

The following list of questions was sent to residents of some of the northern counties of the State:

1. What per cent of land in your vicinity is heavily timbered? Lightly timbered? Barren?
2. Estimate the damage done by forest fires in your locality during 1887.
3. Name the kinds of property in the order of loss sustained.
4. State the causes of fires.
5. What means, if any, are used most effectually to check or prevent forest fires?
6. In what ways is timber wasted in clearing?
7. Give instances from your experience or observation of any climatic change due, as you suppose, to deforestation in your section?
8. Does your county or vicinity need any forestry legislation? If so, what? And what measures would you advise?

To these questions the following replies were received:

FROM A. S. KEDZIE, GRAND HAVEN, MICH.

Prof. W. J. Beal:

In reply to your recent inquiries in order:

1. Lands in this county bearing timber were all heavily timbered, both hardwood and pine. Excepting some 5,000 acres the original heavy timber has been cut off, leaving now some 6,000 acres of original, low marshy prairie, cleared farms and the remainder with a heavy body of undergrowth.
2. Both between this city and Muskegon on the north and Holland on the south considerable damage was done by the fires of 1887. I have no means of telling how much, but many acres were burned over.
3. The property thereby destroyed was chiefly second-growth timber.
4. Carelessness in clearing land. Possibly sparks from locomotives may have been one cause, but this I do not positively know; nor have I reason to think that fires were started by careless hunters. Some may have been.
5. The fires south of this city were fought by denuding the soil of combustible material in advance of the fire. This was done by those whose property was endangered, and by others caring for them.
6. Timber has become too valuable to be wasted in clearing land. What cannot be used in manufactures or in fencing is cut for firewood.
7. Have made no observation of climatic changes by deforestation.
8. Legislation would be in place holding men to stricter account for letting fire get beyond control; for wanton carelessness in allowing fires to get started in the forest. Especially should railroads be held accountable for starting fires, either by their careless men or by their engines.

FROM J. H. MOORES, LANSING, MICHIGAN.

Prof. W. J. Beal, Agricultural College, Michigan:

DEAR SIR,—I make the following answers to your forestry questions, which apply to town 24 N., 6 W., Missaukee county, viz:

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1. Heavily timbered hardwood 50 per cent.; cleared farms, 1-6; pine, 1-12; pine choppings, 3-12. No actual barrens.
2. Very little.
3. Mostly hemlock timber, which is more easily killed by fire than any other.
4. Settlers clearing, mostly.
5. None. Wait for the Lord to send rain.
6. Finest of maple, elm, etc., are burned up in heaps, as there is no market for the wood or lumber, and must have the soil to get a living from.
7. Remember none, except increased cold winds of winter, and consequent drifting of snow when timber is removed.
8. It would be impossible, or at least not practicable, to enforce a law against settlers burning their fallows in dry times.

FROM GEO. C. NEVINS, PRINCIPAL OF SCHOOLS, CHEBOYGAN, MICHIGAN.

1. Of the unimproved land about fifty per cent are heavily timbered, thirty per cent. lightly, and twenty per cent. are barrens.
2. Estimated at forty thousand dollars. Each of two firms reports a loss of ten thousand dollars on standing timber and logs on rollways.
3. Standing pine, logs, cedar, cordwood and stovewood and buildings.
4. Probably settlers' clearings start the greatest number, but these are in "timbered lands" or hardwood, and are not so extensive or disastrous as fires in pine or cedar timber. Hunters, landlookers, and berry pickers, both white and Indian, start many fires in pine, and it is a question whether fires started by settlers do as much damage as those started by these latter named causes.
5. "Backfires" are used to protect particular pieces of property, but no effort systematically is made to check or prevent fires. The individual protects himself the best he can.
6. Hardwood timber is burned in clearing and large quantities of fine timber are thus destroyed.
7. We do not think that deforestation has yet been extensive enough in this vicinity to influence the climate.
8. Legislation will be of very little value in the newest counties. Settlers feel the burden of their timber, land is cheap, and we cannot *prove* criminal carelessness in the origin of fires.

FROM HON. JOHN T. RICH, COMMISSIONER OF RAILROADS, ELBA, LAPEER CO., MICH.

Prof. W. J Beal, Lansing, Mich.:—DEAR SIR:—In replying to questions in regard to forestry contained in yours of recent date it is doubtful if I can give any information which will be of value to the cause of forestry, as in the locality in which I live there are no forests left except what each farmer has saved for his own use, and which are very seldom damaged by fire.

1. Probably 12 to 15 per cent of the land is still covered by the original forest, which was maple, beach, basswood, ironwood, elm, and ash interspersed with white and red oak. The oak is nearly gone, owing to the fact that it dies and decays since the land generally was cleared. It seems to be old and has ceased to grow.

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2. There was very little damage done by forest fires proper. Considerable fence was burned, but the fires usually did not originate in or get into the small patches of woods which constitute the forests in this locality.

3. Fences and pastures.

4. Locomotives and threshing engines.

5. Where fenced in and occupied by owner it is seldom that fires occur. When they do occur, a furrow plowed ahead of the fire will often prevent its advance. If not practicable to plow, dirt shoveled on to and in front of the fire has proved effective to prevent its spread.

6. In the early days of the settlement of the country timber was burned or felled and allowed to decay. Often the small timber was cut and burned and the large timber girdled; any way to get rid of it. There is no particular waste of timber at present.

7. Early and late frosts to the injury of vegetation are much less frequent than formerly. Perhaps drainage has had something to do with this as well as the removal of the forests. Floods are more sudden and severe and of shorter duration than formerly. The fountain heads of wells and springs are growing lower. There is no appreciable difference in the amount of rainfall. The most severe drouth I have ever experienced was in 1850 or 1851, and the most disastrous rainfall was during the harvest of 1882.

8. I know of no legislation which would have any beneficial effect in preserving the remaining forests, unless it be to require woodland to be fenced against all kinds of domestic stock. When stock are permitted to run in the woods they prevent the growth of young timber by eating, treading down, and by causing grass to grow, which is destructive to all timber. Then the rubbing against the trees and treading around the roots kills much timber.

When your last question is read it leads to the opinion that in alluding to locality or vicinity you would include perhaps a whole county. If so, in Lapeer county, in addition to what has been said, there was formerly in the south and southwestern portion of the county, some oak openings, of which there is about the same percentage left as of the heavy timbered land. Much of the north half of the county was covered with a heavy growth of white pine which is almost entirely gone, and a very large portion of it is now settled, the stumps are being removed and good farms made. The loss by fire in this portion of the county has been larger than in the older settled portion, and many of the fires originated in burning log and stump piles. The losses have in some instances included, in addition to fences and pasture, buildings and stacks of hay and grain; but the loss sustained I have no means of ascertaining.

WHAT HAS BEEN DONE IN OTHER STATES?

[BY W. J. B.]

A brief statement concerning the condition of forestry work in other States, as to when it was begun, what kind of work has been done, the expense involved, and the effects if any. It is taken mainly from the last report of the Division of Forestry, by B. E. Fernow, chief of the Division. The arrangement of States is made geographically, as in the report referred to.

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MAINE.

About sixty-two per cent of the area is still wooded, and it is the opinion of many lumbermen that it is increasing. As early as 1855 an act was passed "to protect forest and timber land from fire." Arbor day was appointed by the governor in 1887 to encourage planting for shade and ornament.

"The immense forests in which the large rivers of the State find their sources were originally worked for pine. A more sensible and economical management has taken the place of the former wasteful methods. This consists mainly in keeping out fires and in not allowing trees below a certain size to be cut, a condition which enters into the land holder's leases to the loggers. The owners of the wild timber lands, whose holdings are in large tracts, often comprising one or more townships, clear no land and sell no land. In southern counties the young pine is now springing up freely in abundance. Farming land is carefully protected."

NEW HAMPSHIRE.

This State has fifty-two per cent of its area in forest. No legislation of pratical service exists. A commission was appointed in 1881 to report upon the condition and needs of forestry. It presented a valuable report, full of practical, conservative recommendations, but no action has followed this report. Laws exist for the purpose of preventing forest fires, but it is said to be doubtful if they have had any effect. The duty of enforcing the law is not imposed upon any particular officer.

MASSACHUSETTS.

Within the last five years considerable attention has been given to forest legislation, imposing heavy fines for willfully or recklessly setting fires that may do injury to timber or other property. Fire wardens are appointed to enforce the provisions of these laws. Any township or city may set apart or purchase land to be devoted to the "preservation, reproduction and culture of forest trees, either for sake of the timber or the preservation of the water supply. Some plantations, made with a view to financial returns or as a protection against winds, are reported from various parts of the State."

The State Board of Agriculture is constituted a board of forestry, and shall supervise all such public domains, and shall make all necessary regulations for their care and use. All revenue, if any results from any reserve, shall be used so far as needed in improving the reserve, and any remaining shall be paid over to the city or town to which the reserve belongs. Arbor day is established, and plantations of certain specified timber trees are exempt from taxation, provided the number is not less than 2,000 to the acre; that the land shall not have been "sprout land," nor that it shall have a value exceeding $15 per acre. The exemption is to continue for ten years from the time the trees have attained a height of four feet. This law is thought to be without effect. Fruit or other trees growing for shade or ornament, are protected by law, under penalty of imprisonment or fine, for cutting or willful injury.

Instruction is given in forestry at the State Agricultural College, and the Mass. Society for Promoting Agriculture offers liberal prizes to encourage tree planting.

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CONNECTICUT.

This State, with twenty-one per cent forest area, in 1886 established Arbor day, and exempted plantations of designated timber trees from taxation for a period of twenty years, providing that land before planting was worth not more than twenty-five dollars per acre. A few lectures on forestry are given in the agricultural course at Yale.

VERMONT.

With thirty-two per cent forest area, "this is perhaps the only State that places a premium upon the removal of the forest, exempting the owners of migratory saw-mills from taxation upon their timber lands for five years." In 1882 a commission was appointed which reported in 1884, and made many good suggestions. No legislation followed, however. Under the existing laws malice and willfulness must be shown in order to secure redress for damage from fires.

NEW YORK.

After much agitation and a report of a temporary commission in 1884, a Forest Commission was created in 1885, for the purpose of managing wisely and upon conservative grounds the forest property of the State; $32,500 were appropriated for its use, under certain limitations.

The commission took in charge the Adirondack forest reserve, and report almost absolute immun ty from fires, as well as a complete arrest of timber thieving and the recovery of $14,000 for trespass, and for timber illegally cut. The State owns 715,000 acres, and the effects of the work of the commission have been so marked that government lands have advanced many times in price.

The officers of the forest administration are three commissioners without salary, a secretary, a warden, an assistant warden, two inspectors, and fifteen foresters, with a monthly pay roll of $1,375.

So long ago as 1876 the statutes contained provisions which, carried out, would have prevented many forest fires, and extensive legislation in regard to the matter of shade trees, forests, and forest fires, existed before the commission was established. With that, however, came additional fire legislation, and each town was divided into fire districts. The commission makes and posts rules for the prevention and suppression of fires.

Mr. A. L. Train, secretary of the commission, says: "Our fire laws are good. * * * Legislation is needed in the direction of perfecting the means of putting the laws in force."

The commission aims at educating the people by the publication of tracts, circulars, etc.

PENNSYLVANIA.

Good fire laws for a few counties have existed since 1870. At the instance of one man, they were enforced in one tract of mountain forest. The legislature of 1887 passed laws looking to the encouragement of tree planting, and to the protection of forests. The first object, the preservation of forest areas, is to be attained by a rebate of taxes on planted or cared-for natural timber lands; but, as it does not result in a saving of more than from 25 to 45 cents per acre, it is little encouragement.

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A law exists allowing reduction of taxes for tree planting along highways, and is reported as a bad thing, the shade being a damage to the roads (because proper road making and drainage are not provided). A State Forestry Commission has been formed, Arbor day inaugurated, and the work begun.

NEW JERSEY.

In spite of apparently good fire laws existing since 1792, about $1,000,000 loss per year is reported from forest fires. Arbor day was established in 1884. This State has extensive sandy plains bearing scrub pine, much like our jack-pine plains.

MARYLAND.

Nothing done for forestry except passing laws for "malicious firing of woods." This will apply to most of the southern States.

WISCONSIN.

This State allows a bounty of two dollars per acre for tree planting, after the trees are twelve feet high. Before that time, lands planted to trees may be exempt from taxation.

There is much loss of timber from fires, although the State has a law to punish offenders.

MINNESOTA.

An act was passed in 1871 to encourage planting and growing of timber and shade trees. Arbor day was instituted by the State Forestry Association in 1876, and legalized by the legislature of 1881, which also appropriated $5,000 to the society to enable it to publish its manual of tree planting. It is estimated there are now between 50,000 and 60,000 acres of planted forest in the State.

OHIO.

The American Forestry Congress was formed in Cincinnati in 1882. A State Forestry Bureau was created in 1885, consisting of three unpaid commissioners. They have as a part of their duties the establishing of a forestry station on the University grounds; $1,000 are appropriated annually to pay necessary expenses.

ILLINOIS.

The law of 1874, offering a bounty of $10 per acre to any one planting forest trees and cultivating them for three years, seems to have had no effect.

ARKANSAS.

"To get rid of the timber" is the only forestry interest reported.

IOWA.

This was one of the first States to teach forestry, and much has been done by the Agricultural College in testing both fruit and forest trees. It early adopted an Arbor day, and as early as 1874 offered twenty-one distinct

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premiums for tree planting on that day. The school law compels the setting and protection of twelve or more shade trees on all school grounds where that number is not already growing.

DAKOTA.

Territorial laws offer an annual bounty of $2 for ten years to any one planting and cultivating one or more acres for three years. If five acres are cultivated and set with trees, the quarter section on which it is situated and all improvements up to $1,000 are exempt from taxation for ten years.

NEBRASKA.

As in most prairie States the public responds readily to the provisions of Arbor day, and the State agricultural society offers three premiums annually for the largest number of trees and cuttings planted on Arbor day. It is said that 1,000,000 acres have been planted to trees in this State.

KANSAS.

The planting has been vigorously prosecuted and with results similar to those in Nebraska. Arbor day has been observed with much interest since 1875. Early in the last year an act was passed by the legislature of Kansas establishing the office of commissioner of forestry, and providing for two experiment stations, (farms of 160 acres each) to be under the management of that officer, for the purpose of growing, testing, and distributing to those applying for them, trees suitable to the soil and climate of Kansas. The Horticultural society of this State is distinguished for the attention it gives to the subject of forestry, and its annual reports abound in valuable information upon this subject.

COLORADO.

This is the only State whose constitution mentions the matter of forestry needs. Not until 1885 was any more made, but then the officer of State forest commissioner was created, and county commissioners and road overseers were made forest officers. Little has been done.

CALIFORNIA.

Within a few years the people of this State have awakened to a desire to preserve their forests from wanton destruction, and have taken active steps in forestry matters. A State board of forestry was established in 1885, and the three men appointed have entered upon a wide range of duties of a practical nature. Good results are hoped for. Six forest experiment stations have been established in different parts of the State. "Experiments have been made looking to the introduction of some valuable trees not indigenous to the State." The commission will ask for more power in carrying out their work, and will especially urge legislation looking to the better controlling of forest fires.

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NOTES FROM GARDEN AND FOREST.

AMERICANS AS A RULE GIVE LITTLE STUDY TO FORESTS.

"Americans are still surprisingly ignorant in regard to their forests and the simplest laws which should govern their management. This indifference is astonishing. We cut recklessly and often needlessly; and often fail to cut when cutting is essential. Fires are allowed to run unchecked year after year through the forest, or to sweep over land upon which new forests would naturally appear. Cattle and other domestic animals range at will through the woods, injuring trees and exterminating seedlings. Our civilzation and our foresight as shown in the care of our forests, is the civilization and the thrift of France two centuries ago. In no other civilized nation of the world are forests so recklessly managed.

"Americans are impatient of any restraint or interference in the management of their property. And yet, unless American land owners, like the land owners of nearly every other civilized people—Great Britain now being the only important exception—are willing to submit to laws, regulating under proper official control the cutting of their forests and the use of their land for agriculture or forest, according to its quality, we must not expect to keep our forest supplies. These supplies are still enormous, but no forests, whatever their extent or richness, are inexhaustible. As one of the wisest observers of all social problems, and one familiar, too, with the requirements of the forest, has pointed out, the condition of public sentiment required to make a proper management of our forests possible, will develop slowly. Americans as a nation need instruction in the laws which govern forest growth and forest management. This lesson they will not learn readily or quickly, and it is probable that they will not learn it thoroughly until compelled to by dire necessity."—*Garden and Forest, Vol. 1, p. 25.*

THE IMPORTANCE OF STUDYING AND CARING FOR FORESTS.

"No system of agriculture can be long successful and profitable which ignores the necessity of cultivating trees, and which does not recognize the fact that much land in every country can only be made profitable by means of trees. The precepts which should be often repeated to farmers are not that trees produce rain or that trees are sacred objects which can not be cut without offense to man and nature. The lessons they must learn, if they hope to compete with the farmers trained under more enlightened systems of agriculture, are that sterile, rocky, hilly ground cannot long be tilled profitably, and that such land can only be wisely used to produce trees; that the pasturage of domestic animals in woods, or on land only suitable for the growth of trees, is an expensive and wasteful system, as unsatisfactory from a pastoral point of view as it is fatal to the forest; that trees are as much out of place in the strong, level lands, really suitable to permanent tillage as cattle are out of place in the woods. And they must learn, too, that woodlands can only be made profitable when the same care is given to the selection of trees with reference to soil and climate as is bestowed upon the selection of grain and other crops, and the rules which nature has established for the perpetuation of forests must be studied and obeyed."—*Garden and Forest, Vol. 1, p. 229.*

THE VALUE OF A GENERAL KNOWLEDGE OF FORESTRY.

"All over our land we are losing millions by ignorance and carelessness on the subject of forest fires. The people do not realize it at all, especially in our western States and Territories. In Oregon, Washington Territory, Montana and Idaho, among the firs and yellow pines, the fires are doing the most damage. I have seen millions of acres made bare by fires that were the result of carelessness along the railways in Washington Territory and Idaho. The very fact that a government forester was ranging in the forests about Puget sound, the Columbia and Williamette rivers, would have a good influence in every lumber camp and along every railroad. I have seen one burning started by a gang of railroad workmen in Washington Territory that destroyed over one million dollars worth of timber. This fire would never have occurred if such carelessness had been made criminal by law, and if an officer of the government had been within reach to enforce it. There is no question but that if $250,000 a year even were properly spent in care of forests and forest education, it would add millions to future values."—*H. C. Putnam in Garden and Forest, Vol. 1, p. 298.*

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SELECTING TREES FOR PLANTING IN AMERICA.

"The nature of the soil and the character of the native vegetation should primarily determine his choice which may depend secondarily, however, upon the purposes to which his forest crop is to be applied, and upon probable future local demands for timber. In European countries where the number of species of trees growing naturally is very small, the scientific forester is rarely compelled to occupy himself with forests composed more than two different deciduous trees, the oak and the beech, but in America forests when sometimes twenty or thirty species of more or less valuable trees are closely associated together in small areas, the difficulties of forest management are greatly increased, and we have still to learn how a mixed forest of many species can be most profitably worked. At present, at least, the owner must select the most valuable species among those which grow the most freely on his ground, and then, the crop being decided upon, devote himself to the development and the succession of the individuals of those species."—*Garden and Forest, Vol. 1, p. 334.*

"A forest of deciduous trees, especially in this country where a large number of different species are almost universally associated together, is more difficult to manage than one composed of conifers, which usually grow gregariously, and are, moreover, little dependent upon artificial thinning and pruning. The operations of scientific forestry are all directed to the perpetuation of the forest. They are based on the principle that trees can be grown on certain land more profitably than any crop, and that, this fact being established, rural economy demands that the forest should be a permanent fixture on such land."—*Garden and Forest, Vol 1, p. 333.*

A SATISFACTORY FOREST.

"There should be in a perfectly healthy and satisfactory forest three stories of vegetation, so to speak. First, a growth of tall trees near enough together to insure the development of tall, straight stems, without low branches, which destroy their value for timber; but not so near that their heads exclude all light from the forest floor, and so prevent the growth among them of other plants; 2d, a crop of younger trees growing under and among the last, either of the same species or of some valuable species capable of supporting shade, and which will replace the older trees when these reach maturity; and 3d, a growth of low undershrubs and seedling trees covering the forest floor, holding the leaves which fall from above, and containing the material for future forests. The task of converting the most neglected and unpromising piece of woods into a forest of this character is not difficult in this climate. It requires only a short time comparatively, but it can not be done without labor, and without careful study of trees, their nature and requirements."—*Garden and Forest, Vol. 1, p. 334.*

HOW TO TELL THE CONDITION OF A TREE.

"The condition of a tree can be roughly decided by an examination of its top. When the upper branches begin to fail, it is a sign that it is no longer in a healthy condition or capable of producing much more material. A tree in scientific forestry is considered ripe and ready for the axe when the bulk of its annual increase of wood diminishes or does not increase."—*Garden and Forest, Vol. 1, p. 334.*

MANAGEMENT OF FORESTS.

"In no branch of agriculture, perhaps, do the people of the United States so need instruction now as in all matters relating to the care and improvement of the woods and woodlands connected with farms. It is almost a universal custom with American farmers to neglect this part of their property, and to be satisfied if the woodlot furnishes a little pasturage, and a scanty supply of half rotten or worm-eaten wood for the kitchen stove.

"It is generally admitted that forests ought not to be pastured. * * * The first requisite in forest life is to keep the ground fully shaded, so much so that grass cannot grow, to keep it moist and free from packing or the tracking of cattle, and to encourage such a growth that drying winds may not enter."—*Garden and Forest, Vol. 1, p. 310.*

"Occasionally some uninstructed person speaks of inexhaustible forests, but by this time it should be pretty generally understood that a forest can be made to yield indefinitely only by restricting its average annual production to its annual increase

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The forest products of Maine, for example, diminished alarmingly after the white pine and spruce in that State had been recklessly destroyed for many years and the entire extinction of its most important industry was threatened. But the people of Maine have learned a dearly bought lesson, and realize now that forests can be destroyed, even though they may have appeared inexhaustible, during the lives of one or two generations of men. The Maine forests are not managed in accordance with the rules of scientific forestry as these are understood in European countries, and beyond question the practice could be improved upon. Nevertheless, this practice is based upon the laws of nature and the necessities which arise from existing conditions, and it is upon these that any system of forest management, however elaborately its details may be worked out, must rest primarily. The Maine lumberman has learned that excessive and unrestrained cutting, supplemented by fire, will destroy any forest, and that a forest from which only the ripe trees are cut at stated periods, while the remainder are carefully protected and allowed in their turn to reach maturity, will continue to produce indefinitely, and to pay handsomer returns in the long run than it would under the usual American custom of indiscriminate cutting without regard to future production. The changes which have been gradually taking place for a number of years in the management of the Maine forests have already borne fruit in their improved condition and increased output. They restore to the Pine Tree State its position as one of the most important of the lumber producing States, not in the actual product of the mills to-day, but in the promise afforded by more intelligent forest management of a steady and constant supply of logs in the future. If the present ruinous practice continues to prevail in Michigan, in Wisconsin and Minnesota, it will not be many years before the annual timber crop of those three great States will fall below that of Maine, and perhaps of some of the other New England States. It is not easy to overstate the importance of the system of forest management which is now being worked out in the Maine woods, and which is the more likely to succeed because it is based upon experience. Its eventual success means prosperity for the State; its failure, practical ruin for a large part of it. Other States can learn much from Maine: and especially that by the patient application of a few sensible rules, rules which nature herself teaches, and by the use of a little forethought and a little common sense, a forest can be made more surely and prematurely productive than property of any other description."—*Garden and Forest, Vol. 1, p. 278.*

AMERICAN FORESTS REQUIRE DIFFERENT MANAGEMENT FROM THOSE IN EUROPE.

"The study of European methods and results in forestry by competent men is, of course, highly valuable, but it is not enough. It is not even the most important thing for us. Nothing can be very useful to us which is not based upon careful study of the facts and conditions which are peculiar to this country. We should have in time a system of American forestry—we must have it, indeed, if we are to avoid serious disasters to our national interests and civilization. We cannot import and adopt ready-made European systems or methods. The forestry of this country must be the product of growth, which has as yet scarcely begun. It will be developed by continued and widespread observation, and by constant comparison of the results of practice. It is necessary to remind ourselves that no useful system of forest management can be originated or created by legislative enactment. There must be considerable special knowledge and considerable national good sense regarding the needs of this country, behind forestry laws, or they will be not only useless, but mischievous."—*Garden and Forest, Vol. 1, p. 26.*

DISADVANTAGES OF COPPICE-WOODS.

"Coppice-woods, that is woods composed largely of suckers, or the growth from the stumps of trees previously cut, it being the custom in some parts of the country, especially in New England, to cut a piece of woods clean, leaving the old stumps to furnish a fresh supply of trees. The disadvantages of this system are, that stump shoots never make as long-lived or valuable trees as seedlings; that as each old stump produces several shoots, these are crowded together so that no one of them is able to grow into a good tree; that some species of trees produce shoots from the stump more freely and more vigorously than others, so that if left to themselves these species must eventually occupy the ground, to the exclusion of all others, and that, as stump land loses its power to produce shoots after two or three crops have been taken from it, a wood treated continually in this way must either disappear eventually or change the character of its composition." * * * —*Garden and Forest.*

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WILL IT PAY TO CLEAN UP THE RUBBISH AFTER CUTTING SOME OF THE BEST TREES?

"The fact that the tops of the pine and spruce trees cut in the Maine woods can be utilized in the manufacture of paper-pulp, has more than local or mere industrial significance. The fires which do such immense injury in the coniferous forests of this country can generally be traced to the tops and branches of trees, left by the lumbermen behind them in the woods. These by the middle of the following summer become perfectly dry and afford the best material to start a fire with, in case a careless hunter or tramp or berry picker drops a lighted match or a spark from his pipe into it. In Europe there is a demand always for such minor products of the forest; and the material itself pays for gathering up every part of the tree which the lumbermen cannot make use of, to say nothing of the increased safety this gives to the forest, and to the priceless surface coating of decaying vegetable mould which fires consume. No one in this country has wanted the tops and branches of trees, and lumbermen have preferred to take the chance of almost inevitable fire rather than paying the cost of having the woods cleaned up behind their operations. The upper part of the main trunk as well as all the branches and chips and all unsound logs, the whole amounting generally to a third of the whole bulk of the tree, has been left in the woods to burn or rot; while in the case of hemlock it is only within a comparatively recent time that any use of the tree except the bark has paid. In some districts in Maine now, however, the tops and larger branches of the trees are gathered; and the wood from which the knots and sap wood is first removed, is thoroughly steamed to extract all resinous matter and then ground into dry pulp. If it is profitable in Maine to do this, it will doubtless prove profitable in other parts of the country; and one of the principal causes of forest fires may perhaps in time be eliminated in this way."—*Garden and Forest, Vol. 1, p. 290.*

A FOREST PRESERVE IN CANADA.

"A movement has been started to induce the Canadian government to establish a forest preserve about the head waters of the Muskoka river which flow into Lake Huron, and of several of the important streams which feed the Ottawa, and which rise in the same region, Island Lake, the head of the Muskoka, being not more than a half a mile distant from Otter Slide Lake, from which springs the Petewawa, a feeder of the Ottawa. This is a picturesque and well wooded country, abounding in lakes and streams and swamps, and still frequented by game and game fish; it is, moreover, one of the most important in Ontario as a natural reservoir. The proposed reservation embraces a territory of 330,000 acres, exclusive of an area of about 60,000 acres more of water. What the promoters of the scheme desire is that the government should create a public forest and define its boundaries; and appoint a forester and assistants to take charge of it; and cut the timber as soon as it is ripe under proper rules and regulations. There can be no doubt that the preservation of a great forest area at the head-waters of such important streams would be immensely advantageous and profitable investment for the Canadian government, not only in the influence it would exert upon the water supply, but in increased and permanent lumber crops, which good management would insure. This is a matter which should appeal to all Canadians interested in the development of their country, and one which the people of the United States will watch with interest, as an example of what must be attempted in this country if our forests and streams are to escape the extermination which now threatens them on every side. It is proposed that the Ontario reserve shall be known as the Algonkin forest."—*Garden and Forest, Vol. 1, p. 219.*

THE PITCH PINE ON THE SANDS OF NEW JERSEY.

"The pitch pine is not one of the most valuable pine trees of the United States. Its wood is coarse grained, full of resin and not very strong. It is in every way inferior to the wood of the southern long-leafed pine, which it resembles in structure and general appearance, but which it will never replace as long as the southern pine forests continue to yield as freely as they do at present. But the time will come, perhaps, when New Jersey pitch pine will play an important rôle in supplying the people of the United States with timber. The southern pine cannot last forever, under the existing management of these forests, and the species which is everywhere replacing it, the old field or loblolly pine (*P. Tæda*) is inferior to the northern pitch pine in the quality of timber it produces. Before southern pine was brought to this market the pitch pine of New

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Jersey was the only available timber in many parts of the State for timbers and flooring; and there are still houses in some counties where floors and floor-timbers are known to have been in constant use for more than a century. But it is for firewood and for charcoal that the pitch pine is most valuable; and the nearness and accessibility of these New Jersey pine forests to great centres of population give them special importance as sources of fuel supply, which no other forests of this character in the country possess. Much land within three or four hours by rail of this city and of Philadelphia, now utterly unproductive and rapidly deteriorating through the fires which sweep over it every year, can be made highly productive and profitable by means of the pitch pine. People who own land of this character will see much to interest and instruct them in these Lakewood forests, and those in the town of Orleans, on Cape Cod, in Massachusetts."—*C. S. S. in Garden and Forest, Vol. 1, p. 166.*

RAILROADS VERSUS FORESTS.

"The building of railroads through a forest in this country means its extermination. This is particularly true of the Adirondack forest. Its escape from extermination in the past is due to the single fact that the hard woods of which it is principally composed could not be got to market from lack of transportation. If transportation is furnished it is merely a question of time when every tree will be consumed in the saw-mill, the paper factory and the charcoal furnace. Railroads will increase, too, the number of fires in the forest and thus hasten its extermination."—*Garden and Forest, Vol. 1, p. 49.*

CONCERNING THE AMOUNT OF TIMBER REMAINING IN NORTH AMERICA.

"If the lumbermen of the United States will take the ninth volume of the 10th Census reports and read the estimates and statistics on the standing timber of the United States and compare them with the amount of timber cut and sold in the past eight years, in connection with careful estimates being now made over the same ground in the timber States of Michigan, Wisconsin, Minnesota, California, Oregon, Pennsylvania and Maine, they will be convinced that time has proved our estimates to have been approximately correct. The careful examination of that census work, especially the object lessons presented by the maps of forest areas, will give, too, some knowledge on timber matters. In Wisconsin, for example, the estimate in 1880 of standing pine was some forty-one billion feet, board measure, of which fifteen billion was in the Chippewa valley. The eight years' cutting and the present amount of standing timber, estimated now at less than ten billion feet, show the 1880 estimate a fair one. * * *

"It is claimed that Michigan has less than thirty billion left, and the amount in Minnesota is probably about eight or ten billion feet. * * *

"To say that there is of the firs, cedars and other merchantable timbers in Washington Territory, Oregon and in the Pend d'Oreille Region of Idaho, five hundred billion feet would, I think, judging from an extensive examination made in 1882 and 1883, and from reliable sources, be low enough. That it will much exceed this estimate when cut, unless fires destroy it, is my belief."—*Garden and Forest, Vol 1, p. 297.*

VALUE OF FOREST PRODUCTS.

"When we thus consider the products of the forest it will not be a surprise to learn that these were estimated in the United States for the year 1880 at $800,000,000. The last government statistics at my command show some of our principal crops to have been:

Wheat	$474,291,850
Cotton	280,266,242
Gold and silver	74,400,000
Coal	94,500,000
Iron ore	20,470,000

"It will thus be seen that the economic value of our forest products is nearly double that of wheat, more than ten times that of gold and silver, and forty times that of iron ore. We are eating into our capital and providing for no renewal of it."—*Abbot Kinney in Garden and Forest, Vol. 1, p. 369.*

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WHERE LEGITIMATE TO USE MONEY.

"Professor E. J. James argues that it is quite as legitimate to expend Federal money to prevent the soil from flowing down mountain sides and filling up rivers as it is to expend money for clearing out their channels when once filled; and that it ought to be permissible to expend Federal money to protect the stream itself, if it be proper to stock and re-stock it with fish."—*Garden and Forest, Vol. 1, p. 396.*

FOREST COMMISSIONS.

"The field of usefulness of these commissions is limited, and their work must be advisory and educational. They must become, if they are to justify their existence, the teachers of the people in all that relates to the forest. * * * * * *

"As our advice has been asked, we shall be permitted, perhaps, to say that the forest commissions of the different States and their friends and all others interested in this country in the question of forest preservation, will accomplish nothing until they unite together in the adoption of some general scheme for educating the people of the United States in the questions relating to the forest. What is needed in this country now is such a discussion of the forest question, such an awakening of the intelligence of the American people to the importance of the forest, that it will be possible to secure (1) legislation from Congress, under which the forests upon the national domain may be administered for the good of the whole people of the United States for all time, and not for rings of contractors and timber thieves whose only interest is to cut every stick of timber, and then, after the forests are utterly ruined, abandon the land to hopeless worthlessness. Such an awakening is needed to secure (2) the enactment of laws in every State, under which forest property may be made secure from depredation and needless fires, and a condition of public intelligence which will make it possible, in the case of the forest, to subordinate private interest to the general good. But before this time comes the people of the country must learn that the welfare of the public is often dependent upon the forest of the individual, and that if the individual is allowed to do with it as he may wish, he endangers the community. The time probably will come when the farmers of the United States will realize that the pasturage of animals in their woods is not only an injury to themselves, personally, but to the whole community, and will consent to forego this privilege. * * * * But the mental development which will make intelligent legislation upon such subjects possible can only come after long years of discussion and education. In inaugurating such discussion and stimulating such education state forestry commissions will find their real and only field of usefulness, and failing in this they will show their unfitness for existence."—*Garden and Forest, Vol. 1, p. 385.*

THE CANADA PLAN OF DEALING WITH FOREST FIRES.

"During the period from May first to October first, there is placed where forest is exposed to danger a man or men who are empowered and instructed to use every endeavor to prevent and suppress fires in every way possible, and the ranger is authorized to engage all the help necessary to cope with fire when prompt action is required. These men give information and distribute copies of the fire act.

"The government nominates the men. The number needed is left largely to the judgment of the people interested.

"As to the expense incident to the working of the plan, the government assumes one-half, the other half is borne by the limit holders. A trial of this plan was made in 1885, employing thirty-seven men. The effect was excellent and entirely satisfactory."—*Adapted from the United States Agricultural Report, Division of Forestry, p. 180, 1886.*

A STATE PARK.

There has been considerable said in favor of authorizing some persons in behalf of the State to select, purchase and look after a tract of 2-5 townships of land for a park or reserve. This should be at the source of some stream or streams, contain a variety of soils and timber and include swamps and lakes. The objects set forth are for studying the effect of such reserve

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on the sources of small streams; to afford an opportunity to study all kinds of wild plants in portions of virgin forests for many years to come; to encourage and protect, fish and wild game which is becoming scarce.

The suggestion has met with the hearty approval of all classes of people living in the northern part of the State and nearly all of the large number consulted in other portions of the State.

For aiding the advancement of science we feel certain that such a park would be a move in the right direction.

Associations of men have already begun to select portions of cheap land which they intend to maintain as a park and for the purpose of raising wild game.

The reader will recall the example the United States Government has set, by assigning a considerable portion of wild land in Wyoming and calling it "a national park." Canada has already done a similar thing. A note concerning the latter was quoted from Garden and Forest and appears elsewhere in this report.

RECOMMENDATIONS.

A difficult but very important duty is required by section 3 of the act providing for a forestry commission, viz., to recommend "such legislation as seems to them expedient to propose to preserve and restore the forest wealth of the State."

1. In view of the fact that supervisors are already burdened with the gathering of a multitude of statistics, and that the aggregate expense of securing the desired information by this method is large in proportion to the value of the matter gathered, we recommend that so much of the law creating the Independent Forestry Commission of Michigan and defining the duties thereof, as refers to the collection and compilation of matters through the agency of township supervisors be repealed, and that henceforth the commission shall secure through the sources which it deems most reliable, the information contemplated in the act upon which to base further action of the commission or future enactment of the legislature.

2. We recognize the difficulties in the way of discreet legislation, in the hope of diminishing the immense amount of annual loss from forest fires, but after mature deliberation, we deem it desirable that greater security be thrown about innocent parties, through the enactment of a law which shall prohibit the building of fires by persons clearing land during the period from April first to November first in each year, without the consent of the supervisor of the township in writing, with previous notice to owners or occupants of adjoining lands, provided that the law may be suspended by majority vote of the board of supervisors of the county in which such township is situated.

3. We recommend that the commission be authorized to investigate the subject of selecting and acquiring, by the State, of cheap lands in one or more locations, to be set aside and maintained as a preserve, and to report to the governor in its judgment the most feasible methods and the probable expense of securing such lands, with any other information it may deem desirable to communicate in connection therewith.

4. To carry on the work required by the law creating the commission, we recommend that the sum of $1,000 be appropriated for the years 1889 and 1890.

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LAWS OF MICHIGAN RELATING TO FORESTS.

TAKEN FROM HOWELL'S ANNOTATED STATUTES.—VOL. 1, '82, CHAP. X.

Shade Trees in Highways.

§1408. SEC. 1. Shade trees shall be planted along both sides of the public highways, at the uniform distance, as near as may be, of sixty feet apart, and not less than twenty-three nor more than twenty-five feet from the center line of the highway, but the township board of any township may direct as to the distance which trees may be set from each other or from the outer line of the highway. All trees now growing upon the sides of any highway, and all trees that may be hereafter planted thereon, standing more than sixty feet apart, shall be preserved and shall not be injured or removed, unless by the direction of the commissioner of highways, and with the consent of the owner of the adjoining land, unless such trees shall interfere with or obstruct the travel on the highway: *Provided*, that the provisions of this chapter in whole or in part shall not be deemed mandatory in townships in which the electors may by vote at a township meeting thus determine.

§1409. SEC. 2. Any person planting trees along the highway adjacent to property owned or occupied by such person, shall be entitled to be credited twenty-five cents upon his highway tax for every tree so planted, but not to exceed in the aggregate twenty-five per cent. of such person's highway tax in any one year.

§1410. SEC. 3. In road districts where there are not trees planted and growing along the highways to the extent required by the first section of this chapter, the commissioner shall require that at least fifty trees per year be so planted in each district, and shall continue to require the same from year to year, until every highway in his township where the adjoining lands are cleared, is supplied with shade trees as contemplated by said first section, but not more than twenty-five per cent. of the highway tax shall be appropriated for such purpose in any one district in any one year. The overseer, acting under the direction of the commissioner, may require twenty-five per cent. of the highway tax of any person in any year, to be paid in money, the same to be applied in planting shade trees along the highway adjoining the property of such person. The overseer shall particularly attend to the planting of such trees, and shall allow no unsuitable tree, nor any tree wanting sufficient roots or vitality to be planted, and he shall have the charge of and the care for the same in the best manner for their growth.

CHAPTER 7, VOL. 1, '82.

Powers of Council.

§2867. SEC. 21. The council may provide for and regulate the planting of shade and ornamental trees in the public highways, streets and avenues of the village, and for the protection thereof. * * * * *

CHAPTER 83.

Planting and Protecting Trees in Villages.

§3065. SEC. 1. *The People of the State of Michigan enact*, That it shall be lawful for the street commissioners of any incorporated village, upon the written application of any six freeholders of such incorporated village, to grant permission to the said freeholders, or any one of them, to plant in any of the public streets, lanes or highways of such village, contiguous to property owned by any of the freeholders making such application, shade or ornamental trees, and to provide suitable protection for and around any shade or ornamental trees now growing or hereafter planted within such village: *Provided*, That nothing herein contained shall authorize such street commissioners to grant permission to any person to plant trees in violation of any ordinance of such village.

§3066 SEC. 2. Such permission may be made by such street commissioners, in writing, and may be filed by the party or parties receiving it, in the office of the clerk of such village; and after the said permission shall have been so filed, it shall not be lawful for any person to cut down, mutilate or destroy said trees, so long as they are alive or growing, under the same penalties which would attach to persons guilty of mutilating or destroying trees growing within an enclosure or occupied premises.

§3067. SEC. 3. It shall not be lawful for any person to cut down, mutilate or destroy shade or ornamental trees that have been standing in any highway, public park, street,

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lane or alley of such village, for the period of five years previous to the passage of this act, so long as said trees are alive or growing, or any shade or ornamental trees which have been heretofore planted, or to cut down, mutilate or destroy the protections placed around any shade or ornamental trees; and any person who shall willfully and maliciously violate the provisions of this act, shall be punished by fine not exceeding twenty-five dollars, or by imprisonment in the county jail not more than sixty days.

Cutting Decayed and Dangerous Trees, p. 884.

§3442. SEC. 1. *The People of the State of Michigan enact*, That any railroad company owning, controlling or operating any line or lines of railroad in this State, be and is hereby authorized and required to cut any tree or trees that are dangerous and are liable to fall or blow over and obstruct the track.

VOL. II. CHAPTER 272, PAGE 1679.

Trespassers on Lands.

§7957. SEC. 1. Every person who shall cut down or carry off any wood, underwood, trees or timber, or shall girdle or otherwise despoil or injure any trees on the land of any other person, without the leave of the owner thereof, or on the lands or commons of any city, township, village or other corporation, without license therefor given, shall be liable to the owner of such land, or to such corporation, in three times the amount of damages which shall be assessed therefor in an action of trespass, by a jury, or by a justice of the peace in the cases provided by law.

CHAPTER 318, PAGE 2215.

Offenses Against Property.

§9129. Any person who shall willfully and maliciously burn or otherwise destroy or injure, any pile or parcel of wood, boards, timber or other lumber, or fence, bars or gate, or any stack of grain, hay or other vegetable product, or any vegetable product severed from the soil and not stacked, or any standing trees, grain, grass or other product of the soil, or the soil itself, of another, shall be punished by imprisonment in the State prison not more than five years, or by fine not exceeding five hundred dollars, or imprisonment in the county jail not more than one year.

Malicious Injury and Destruction of Personal Property.

§9183. SEC. 1. *The People of the State of Michigan enact*, That any person who shall willfully and maliciously drive, or cause to be driven or imbedded, any nail, spike, or piece of iron, steel or other metallic substance into any timber log or bolt which may now be, or may hereafter be put on the banks of or in any of the waters, or any mill-yards of this State, for the purpose of being made into lumber or marketed, shall be guilty of a misdemeanor, and upon conviction thereof, shall be punished by a fine not exceeding one thousand dollars, or by imprisonment in the county jail, not more than one year, or both such fine and imprisonment, in the discretion of the court.

Protection of Land and Punishment for Cutting and Carrying away Timber therefrom.

§9184. SEC. 1. *The People of the State of Michigan enact*, That every person having no color of title, either tax, equitable or otherwise, who shall willfully and without permission of the owner thereof, enter upon the lands of another, and shall cut down, destroy or remove therefrom any tree, trees, timber, wood, logs or lumber, growing, standing, lying or being thereon, of the value of twenty-five dollars or more, or shall willfully induce, direct, aid or abet any other person in so doing, shall be deemed guilty of a felony, and shall be punished by imprisonment in the State prison not more than one year, or by fine not more than five hundred dollars, and imprisonment in the county jail not more than twelve months.

§9185. Sec. 2. If the tree, trees, timber, wood, logs or lumber so cut down, destroyed, or removed, shall exceed the value of one dollar, and shall not be of the value of twenty-five dollars.

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CHAPTER 328.

Firing of Woods and Prairies.

§9402. SEC. 1. Every person who shall willfully or negligently permit any fire to pass from his own woods, prairies, or grounds, to the injury or destruction of the property of any other person, shall be deemed guilty of a misdemeanor and on conviction thereof, shall be punished by a fine not exceeding one thousand dollars, or by imprisonment in the county jail not exceeding one year, or both, in the discretion of the court; and shall also be liable to the party injured in double the amount of damages sustained.

§9403. SEC. 2. Whenever the woods or prairies in any township shall be on fire, so as to endanger property, it shall be the duty of the justices of the peace, the supervisor and the commissioners of highways of such township, and each of them, to order such, and so many of the inhabitants of such township, liable to work on the highways, and residing in the vicinity of the place where such fire shall be, as they shall severally deem necessary, to repair to the place where such fire shall prevail, and there to assist in extinguishing the same or in stopping its progress.

§9404. SEC. 3. If any person shall refuse or willfully neglect to comply with such order, he shall forfeit a sum of not less than five nor more than fifty dollars.

CHAPTER 329, PAGE 2273.

Trespasses on the Public Lands.

§9405. SEC. 1. *The People of the State of Michigan enact*, That every person not thereto lawfully authorized, who shall willfully and knowingly enter upon any of the lands of this State, or any lands held in trust by this State for railroad purposes, or for any purpose whatsoever, and shall cut down or destroy, or cause to be cut down or destroyed, any trees standing or growing thereon, if the value of such trees so cut down or destroyed shall exceed the sum of twenty-five dollars, shall be deemed guilty of felony, and shall be punished by imprisonment at hard labor in the State Prison not more than five years, or by fine not less than one hundred nor more than two thousand dollars.

§9406. SEC. 2. Every person who shall take and carry away any trees or parts thereof, or any timber or lumber made therefrom, so cut or destroyed, or heretofore so cut down or destroyed, on such land, wherever in this State the same shall be, with intent to convert the same to his own use or the use of his employer or principal, if the same shall exceed in value the sum of twenty-five dollars, shall be deemed guilty of a felony, and shall be punished by imprisonment in the State Prison not more than five years, or by a fine not less than one hundred nor more than two thousand dollars, and imprisonment in the State Prison not less than three nor more than twelve months.

§9407. SEC. 3. If the trees so cut down or destroyed, or the trees, parts of trees or timber or lumber made thereof, so taken and carried away, shall not in value exceed the sum of twenty-five dollars, the person offending shall be punished by imprisonment in the State Prison not less than three months nor more than one year, or by fine of not less than fifty nor more than one hundred dollars, and imprisonment in the State Prison not more than three months.

§9408. SEC. 4. In any indictment or information under this act, the person accused may be charged with commencing at some particular time to commit any of the acts hereby made punishable, and continuing to commit the same to some other time, which period shall be therein stated, and if the jury shall find the accused guilty, they shall in their verdict state the value of the property so cut down or destroyed, or taken and carried away.

§9405. SEC. 5. All prosecutions under this act may be either by indictment or information in the circuit court for the county in which the offense was committed, or such other county as the same may be removed to, as hereinafter provided, but no such indictment or information shall be filed until the accused party has been held for trial upon a preliminary examination, had within the county where the alleged offense was committed, as in other prosecutions for felony. When any such accused party is held for trial upon any such preliminary examination, the commissioner of the circuit court in which any such prosecution may be pending, may, on the motion of the prosecution made by the prosecuting attorney, attorney general, or commissioner of the State land office, for cause shown, change the venue thereof to any county in this State, and thereby transfer said cause to any county in this State for trial, in all respects the same, and for the same causes that said courts are now authorized to change the venue in criminal cases on motion of the defendant.

§9410. SEC. 6. Any person having knowledge of sufficient facts may make a com-

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plaint for commencing a prosecution under this act, the same as in other criminal prosecutions, and the same proceedings shall thereupon be had, and whenever the commissioner of the State land office shall suspect that an offense has been committed against any of the provisions of this chapter, he shall make an affidavit and file the same with any justice of the peace of the county where the offense shall be suspected to have been committed, specifying the offense, and naming the person or persons suspected of having committed the same, and if he shall be unable of his own knowledge to state sufficient facts and circumstances to authorize the issuing of a warrant, such magistrate shall, after the filing of such affidavit, issue subpœnas directed to and compel in the usual manner the attendance of witnesses, who may be required to testify to the best of their knowledge concerning such facts and circumstances, and if it shall appear to such magistrate from such affidavit, or from the examination of such witnesses, as the case may be, that an offense has been committed against any of the provisions of this chapter, he shall issue a warrant directed to the sheriff or any constable of the county, reciting the substance of the accusation, and commanding him forthwith to take the person accused of having committed such offense, and bring him before such magistrate to be dealt with according to law, and the same warrant may require the officer to summons [summon] such witnesses as shall be therein,named. All further proceedings taken in any cause so commenced, shall be according to the practice now or hereafter prescribed by law for the examination of offenses not cognizable by justices of the peace. The legal fees of the magistrate, officers and witnesses necessarily incurred in such examination, other than such costs as may be incurred after such cause shall have been transferred to the circuit or district court, shall be paid by the State treasurer on the warrant of the auditor general, to whom the taxed bill shall be delivered, duly certified to be correct and just by the attorney general or prosecuting attorney of the county.

§9411. SEC. 7. If any person, being the owner of or having any interest in any sawmill, shall, by himself, his agent or servant, use the same in sawing or manufacturing any logs, timber or lumber, so unlawfully cut down or destroyed, taken and carried away, or shall, by himself, his agent or servant, receive the same for the purpose of so sawing or manufacturing the same, at such mill, knowing the same to have been so cut down or destroyed or taken and carried away, he shall be deemed guilty of felony, and shall be punished as first mentioned in this act, and shall be proceeded with in the same manner, and with the same effect in all respects, as if charged with the offense first mentioned in this act. In case the owner, owners or managers of any sawmill used for the purpose of manufacturing timber, thus unlawfully obtained, into lumber, shall be a non-resident or non-residents of this State, the mill or mills, lands and personal property of such non-resident owners, lessees or holders under a mortgage, which property shall be proven to be used or engaged in the unlawful removing of timber from the public or private lands of this State, such property or real estate shall be holden as immediately and directly liable for any and all damages sustained by its unlawful use for purposes aforesaid. Upon proof thereof, the court of competent jurisdiction may forthwith direct the sheriff of the county to take such property or estate into custody, or demand sufficient security therefor, to cause it to abide the decision of the case by due course of law. The damages shall be appraised at not less than double the amount of the market price of the lumber at the mill, which the timber thus unlawfully taken was capable of affording. Upon a rendition of judgment and issue of execution, relating to the property or estate of such non-residents, mill owners or parties in interest thereto,the sheriff shall proceed,in default of other payment, to sell the same, or a sufficient portion thereof, to satisfy the execution committed to him, as provided in other cases by law for sales of real or personal estate on execution.

§9412. SEC. 8. It shall be the duty of any attorney having charge of any prosecution under this act, to make diligent inquiry for the party accused, and endeavor to cause him to be arrested and tried without unnecessary delay; and whenever he shall be satisfied that the accused is not within the State, but is liable to be demanded by the governor of this State as a fugitive from justice, he shall report the fact to the governor, and transmit to him a copy of the indictment, or of the information and affidavit, duly authenticated under the seal of the court, in order that the governor may demand such fugitive as provided in any act of congress.

§9413. SEC. 9. All fees and costs accruing under this act, after being duly taxed as required in other criminal cases in the circuit or district court, and certified to be correct and just by the judge thereof, shall be paid by the State treasurer on the warrant of the auditor general, to whom the taxed bill shall be delivered, out of the primary school fund, when the offense prosecuted shall relate to primary school lands, and out of the proceeds of the sales of the swamp lands, when it relates to said lands; and all

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fines collected under this act shall be paid to said State treasurer and treated as a part of the primary school fund or the swamp land fund, as the case may be. And whenever the attorney prosecuting the offense shall make and forward an affidavit to the auditor general naming any particular person as the informer, by whose diligence the accused was detected and convicted, the auditor general shall on the application of such person, his executor or administrator, draw his warrant on the State treasurer in favor of such person for one-half the amount of the fine collected in the case where he was such informer, which warrant shall be paid by said treasurer out of the moneys collected for such fine.

§9414. SEC. 10. This act shall not be construed to affect any offense or trespass already committed on or concerning any such lands, nor the right of the State to prosecute or sue for the same; but such prosecutions or suits may be instituted and shall proceed and have the same effect as if this act had not been passed.

PUBLIC ACTS, 1885 [NO. 90], PAGE 92.

AN ACT to amend section seven thousand six hundred and twelve of compiled laws of eighteen hundred and seventy-one, being section nine thousand one hundred and eighty-four of Howell's Annotated Statutes relative to the protection of land and punishment for cutting and carrying away timber therefrom.

SECTION 1. *The People of the State of Michigan enact*, That section seven thousand six hundred and twelve of the compiled laws of eighteen hundred and seventy-one, being section nine thousand one hundred and eighty-four of Howell's Annotated Statutes relative to the protection of land, and punishment for cutting and carrying away timber therefrom, be and the same is hereby amended so as to read as follows:

(7612.) SECTION 1. Every person having no color of title, either tax, equitable or otherwise, who shall willfully and without permission of the owner thereof, enter upon the lands of another and shall cut down, destroy, or remove therefrom any tree, trees, timber, wood, logs, or lumber, growing, standing, lying, or being thereon, of the value of twenty-five dollars or more, or shall willfully induce, direct, aid or abet any other person in so doing, and every person who shall knowingly receive into his possession, or permit to be stored in or upon any premises, mill yard, or boom, in his possession, or shall purchase or shall manufacture or cause to be manufactured into lumber, shingles, lath, or other products, any trees, timber, wood, or logs so cut down or removed, knowing the same to have been cut or removed without permission of the owner, with intent to induce, profit, aid, or abet any other person in such cutting down or removal, or to profit himself thereby, shall be deemed guilty of a felony, and shall be punished by imprisonment in State prison, not more than one year, or by fine of not more than five hundred dollars or imprisonment in the county jail not more than twelve months.

Approved May 11, 1885.

PUBLIC ACTS, 1885 [NO. 142], PAGE 158.

AN ACT to amend section ten of act number two hundred and thirty-eight of the session laws of eighteen hundred and seventy-nine, being an act entitled "An act to protect logs, lumber, and timber, while floating upon the waters in this State, or lying upon the banks or shores thereof," being compiler's section two thousand and fifty-eight, Howell's Annotated Statutes of the State of Michigan.

SECTION 1. *The People of the State of Michigan enact*, That section ten of act number two hundred and thirty eight of the session laws of eighteen hundred and seventy-nine, being an act entitled "An act to protect logs, lumber, and timber while floating upon the waters in this State, or lying upon the banks or shores thereof," being compiler's section two thousand and fifty-eight, Howell's Annotated Statutes of eighteen hundred and eighty-two, be amended so as to read as follows:

SEC. 10. Whenever any logs, timber, boards, planks, spars, boomsticks, spiles, shingle bolts, railroad ties, or fence posts, in rafts or otherwise, shall be drifted or float upon any island in any of the waters or streams in this State, or upon the banks or shores of such waters or lands adjacent thereto, the owner of such logs, timber, boards, planks, spars, boomsticks, spiles, shingle bolts, railroad ties, or fence posts, or any person or corporation entitled to the possession thereof, may at any time within eighteen months remove the same upon paying or tendering to the owner or occupant of such bank, shore, or lands, such reasonable damages as may have been caused by such occupancy and removal, but if the amount of such damages cannot be agreed upon by the owner or occupant of such bank, shore, or land, and such owner, person, or corporation entitled to such logs, timber, boards, planks, spars, boomsticks, spiles, shingle bolts, rail-

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road ties, or fence posts, either of them may elect to have the amount of said damages left to arbitration in the manner following: The party or parties so electing, or their authorized agent or attorney, shall serve a written notice by mail or otherwise, upon such other party or parties, reciting the fact that they elect to have such damages left to arbitration, and that they will meet such persons, their agents or attorneys, at the office of some one of the justices of the peace of the township, where such island, banks, shore or land is situated, at a time in said notice mentioned, not less than six days nor more than twenty days from the time of the service of said notice, at which time and place, such parties or their authorized agents or attorneys shall meet to choose such arbitrators as aforesaid, in the manner following: The party giving notice, or his, her, or their authorized agent or attorney shall select one person to act as one of said arbitrators, and the party so notified, his, her, or their authorized agent or attorney, shall choose another, and these two thus chosen shall select a third: *Provided*, That all persons chosen under the provisions of this act shall be chosen from among the freeholders residing in the township or an adjoining township where such island, bank, shore or land is situated. And if said parties, his, her, or their authorized agents or attorneys, cannot agree upon the selection of said persons as arbitrators, then either or any of such parties may certify such fact or facts, to one of the justices of the peace of such township as aforesaid, who shall upon the receipt of such certificate proceed at once to make a list of the names of eighteen freeholders who shall be, either residents of such township, or of such township and adjoining townships, and the parties aforesaid shall strike out, alternately, the plaintiff first striking out, one name from the said list, until only three names remain, and the freeholders whose names so remain upon the list shall act as such arbitraters. Said justice of the peace shall notify said persons so selected, who shall appear before such justice at a day set by him, at a time not less than three nor more than ten days from the service of said notice. At such time so set for the meeting of said arbitrators, they shall appear and be sworn or affirmed to justly and equitably try all matters in relation to such damages and shall proceed to hear testimony and decide the amount of said damages. The said arbitrators shall have the right to view the said island, bank, shore, or land, the occupancy of which is in controversy. The said arbitrators shall have all the powers usual to arbitrators. When the said arbitrators shall have determined the amount of damages, they shall, if chosen by the interested parties as first provided in this section, certify the same to one of the justices of the peace in the township where the said island, bank, shore, or land is situated, who shall thereupon enter a judgment in his docket for such award against such owner, person, or corporation entitled to such logs, timber, boards, planks, or floatables, and execution shall issue thereon as in other cases in justices' courts. But if the arbitrators shall have been designated from any list of names as provided in this section, they shall certify the amount of damages to the justice of the peace making such list, and he shall in like manner enter judgment, and execution shall issue thereon the same as in other cases in justices' courts. Should either party complain of such award, such party may appeal to the circuit court of the county where such island, bank, shore or land is situated, by giving bonds for the amount of such award and costs, but such appeal shall not be allowed except for reasons as set forth in sections nine and ten, chapter two hundred and ninety-two of Howell's Annotated Statutes. If such logs, timber, boards, planks, spars, boomsticks, spiles, shingle bolts, railroad ties, or fence posts, shall not be removed within said eighteen months under the provisions of this section, the owner thereof shall be deemed to have forfeited all right thereto, and such owner or occupant of said lands may make out a sworn statement containing a description of the lands on which said logs, timber, boards, planks, or floatables are lying, the number of logs, and the amount of timber, boards, plank, spars, boomsticks, spiles, shingle bolts, railroad ties, or fence posts as nearly as may be, and the marks thereon, if any, and the length of time the same have remained on said land, and upon delivering such statement to any sheriff, deputy sheriff, or constable, such officer shall proceed and make sale of such logs, timber, boards, plank, spars, boomsticks, spiles, shingle bolts, railroad ties, or fence posts, at public auction, at some convenient and public place in the vicinity thereof. Immediately on making such sale, such officer shall pay over to the owner or occupant of such lands the proceeds of such sale less his fees for making the same, which fees shall be the same as upon levy and sale upon execution: *Provided*, That no sale shall be made without giving ten days' notice to the owner of such logs if known; and if not known, then such officer shall give like notice as he would be required to give on sale of personal property on execution, and when such sale shall have been made he shall thereupon make his certificate, stating the time and place of sale, the number or amount of logs, timber, boards, planks, spars, boomsticks, spiles, shingle bolts, railroad ties, or fence posts sold and the marks thereon, if any, and the name of the purchaser or purchasers, the amount paid and the disposition of

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the same. He shall at once annex such sworn statement to said certificate, and file the same in the office of the county clerk of the county in which the sale was made: *Provided further*, That when the property mentioned in section one of this act, shall be or lie upon any improved farming lands of this State, adjoining any of the waters mentioned in said section one, if the owner or occupant of such lands shall make the affidavit hereinbefore required, and shall cause a copy of said affidavit to be personally served on the owner or agent of the owner of the property mentioned in said affidavit, if said agent or owner be known to the owner or occupant of said lands, but if not known to said owner or occupant then he shall cause a copy of said affidavit to be published in one or more newspapers in said county in which said land is situated, for three successive weeks if there be one, but if not, in one of an adjoining county, and a copy of the same shall be sent to the office of the booming or log-running company having such property in charge or doing business on such streams if known by said owner or occupant, said notice to be sent by mail or otherwise, which said notice shall require said owner or agent to remove said property mentioned in the said affidavit, within thirty days after the receipt of said notice. If said owner shall neglect or refuse to remove the said property, and pay all reasonable damages and charges thereon, then said owner or occupant may remove the same to the adjoining stream or to the banks thereof, and if the same is not claimed by the owner thereof within six months thereafter, and all reasonable charges and damages are not paid, the owner or occupant of said land is empowered to sell the same at public auction to the highest bidder by giving the same notice as required by law in sales of personal property by sheriffs and constables; said sale to be conducted as hereinbefore provided for the sale of logs, timber, boards, planks, spars, boomsticks, spiles, shingle bolts, railroad ties, or fence posts, having lain for eighteen months upon such land, and the proceeds applied in the same way as provided in case of the sale of such logs, timber, boards, planks, spars, boomsticks, spiles, shingle bolts, railroad ties, or fence posts: *And provided further*, That all reasonable damages and expenses incurred and suffered by the owner or occupant of such lands shall be a lien upon such logs, timber, boards, planks, spars, boomsticks, spiles, shingle bolts, railroad ties, or fence posts, until paid.

Approved June 5, 1885.

PUBLIC ACTS [No. 153] PAGE 198.

AN ACT to provide for the assessment of property, and the levy and collection of taxes thereon.

SEC. 76. It shall be unlawful for any person to cut or remove any logs, wood, or timber from any lands sold and bid in by the State of Michigan for the non-payment of taxes, while such taxes remain unpaid and the State remains the owner of such lands by virtue of such sale, and if any person shall cut or remove such logs, wood or timber from such lands during the time aforesaid, the auditor general or his deputy shall issue a warrant under his hand, in the name of the People of the State of Michigan, directed to the sheriff of the county where such lands are situated, giving therein a description of such lands, the amount of such taxes, with interest and charges thereon then remaining unpaid, commanding such sheriff forthwith to seize such logs, wood or timber wherever the same may be found in any county in this State, and to sell the same or a sufficient quantity thereof to satisfy such taxes with the interest and charges thereon and the costs of such seizure and sale. The sheriff shall receive such warrant and execute the same, as therein directed, as in case of levy and sale on execution, and make return thereof with his doings thereon to the auditor general, within sixty days after the receipt of the same and pay over all money collected thereon to the State treasurer. The auditor general shall furnish the State trespass agent with lists or plats of land bid in by the State, and remaining unpaid, and the said trespass agent shall examine such lands and promptly report to the auditor general all violations of the provisions of this section.

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FIRST ANNUAL REPORT

OF THE

AGRICULTURAL

EXPERIMENT STATION

OF THE

STATE AGRICULTURAL COLLEGE OF MICHIGAN

FOR THE

YEAR ENDING JUNE 30, 1888.

[For Members and organization of the Board of Agriculture in charge of the Station and the list of officers, see pp. 4 and 6 of this volume.]

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REPORT OF THE DIRECTOR OF THE EXPERIMENT STATION.

To the Honorable State Board of Agriculture:

I have the honor to submit the first annual report of this station, with accompanying reports of its several officers. The time covered by the report is from February 26, 1888, to June 30, 1888.

I shall not follow the historical development of the station, as a department connected with the Agricultural College, save far enough to see as plainly as may be what is its purpose, and to enable us so far as possible to define its true scope.

While the experiment station is not a new institution, it is of comparatively recent origin. For many years there had been an indefinite sentiment that there is a field for investigation and experiment in agriculture. It is only within the last tweny-five years that this sentiment has assumed form and recognition. Even as late as 1862 the subject of agricultural experiments was of such slight prominence that it was only incidentally referred to in the congressional act endowing agricultural colleges. Since that date the demand has grown up that there should be affirmative and specific work in that direction, and in many of the States considerable sums have been appropriated for stations, and men have been employed whose time and scientific knowledge have been devoted to the unsolved problems of agriculture.

DISCRIMINATION IN FAVOR OF AGRICULTURE.

It was for a time a debatable question whether the State had a right or was properly called upon to single out one of the vocations of its citizens for such special legislation and public expenditure. But a careful consideration of the question will show such a distinction as to warrant the apparent discrimination. In another place I have considered this point, and I beg leave to quote briefly from what was then said.

There is a radical difference between agriculture and the mechanic arts, which deserves to be noted. We find a much larger element of uncertainty in the one than in the other. A skilled artisan can select his material and apply his principle and construct a machine that shall be practically complete, perfect, and in accord with his plans and expectations. But no farmer can with certainty predict the outcome of his labors. What with the weather, untimely frost, difference in soils, blight, and mildew, uncertain germination, injurious insects, birds, and animals, coming unheralded and in unexpected character and numbers, noxious diseases to crop and beast, and the vicissitudes of seed-time and harvest, there would seem to be too much

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uncertainty in agriculture to call it a science, and too many elements of doubt to be solved anywhere by any one, much less in a school room by theorists. For this reason the agricultural college ought not justly to be held to as strict an accountability for certainty in scientific results as institutions more distinctively scientific. You can make an absolutely correct mathematician, a reasonably pure linguist, a fair logician, and a watchmaker who can construct a time-piece that will not vary thirty seconds in as many days; but no agricultural college can turn out a farmer that can raise exactly 31 bushels and 27 pounds of wheat per acre, year after year, on the same field, or in the same year on two fields of similar character. Agriculture is in a sense too broad to be a science, or rather is the co-ordinate contribution of so many sciences that the field is too broad for any one man. Nature and Providence have much to do with its processes, and we can only assist the one and submit to the other; we can control neither.

This being so, the natural inquiry is, why then have the agricultural college or the experimental station? The answer is obvious. A special and thorough knowledge of the laws of nature as allied to agriculture will reduce the reducible uncertainties to a minimum and raise the production to a maximum. The college traverses all these points and brings to bear all cognate sciences. There are causes for poor crops that can be prevented, and there are processes to be discovered and taught that can promote production, whether it be in a hill of white beans or in the fattening of a steer. The range of practical knowledge is so great that it is unwise to leave its acquirement to the uncertain chances of the chance farmer with chance information. The industry is so great that it is entitled to bring to its aid all that science can bestow, experiment can demonstrate, and observation can classify. The farmer should be the first to reap the benefit of any new development of science, instead of being, as now, the last; he is entitled to have at hand the means to apply for himself and test and experiment; and these means are furnished by the agricultural college and experiment stations. There has been too little intellect and too much luck in his processes, too little live investigation and too much following in the rut made by others.

WHICH—STATE OR NATION?

The fact, then, being settled that the community should "foster agricultum" in the way of experiments, a large proportion of which would confessedly be failures, for the reason that no individual could carry them on, it was for a time a matter of discussion whether this should be exclusively the work of the States, or whether the nation had such an interest in the matter as to warrant an appeal to national aid. It soon became obvious that the action of the States in this direction was uncertain, sporadic and limited; that there was no such chance for co-operation as would bring about the best results. It was therefore determined to ask for an appropriation from congress, and the first systematic action in that direction found expression in the presenting of a bill to the 47th congress. The claim for aid was all the more logical and practicable for the reason that congress had, by its act of 1862, furnished the means by its land grant for the establishing in the several States colleges for the benefit of agriculture and the mechanic arts, and this application was made supplementary thereto. Congress had, by its action, caused to be placed in each State an agent for the new work, which

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could be profitably and economically utilized. The plants for ready use were, in large measure, at hand, while a corps of professors and scientific gentlemen were equipped for the experiments and investigations required. The "stations" were to be *in connection* with the agricultural colleges, a *department thereof*. Nothing is clearer than that it was the intention on all sides that the equipment of the college was to be used. That the brains and the plant should in a measure be diverted or assigned to this new department, and not that this new department should be made up of an entire new set of men and a set of independent laboratories and general equipments. Otherwise there would have been no justifiable reason for placing them in connection with the colleges.

STATIONS TO BE AT THE AGRICULTUAL COLLEGES.

Congress would have hesitated long before it would have assented to the building up of an entire new set of institutions, with a duplication of men and plants. There was good reason for believing that in the development of the "agricultural college" there have become associated with it and its several departments an aggregation of scientific thought and research, which could by concerted action accomplish substantial results. Presented in this light, congress readily acquiesced in this movement, and finally passed a bill, which became a law, at the close of the 49th congress (March 2, 1887).

FUNDS NOT FOR EDUCATIONAL PURPOSES.

Another point is equally shown, to wit: That while the "station" is to be connected with the college the new department thus constituted should be honestly used for experimental and not for educational purposes; that the fund provided for in the act should not be placed in the general fund of the college for current expenses. Upon the good faith of the colleges in this regard will depend the continuance of the appropriation provided by the act. The object of the act is clearly set forth in its second section, to wit:

SEC. 2. That it shall be the object and duty of said experiment stations to conduct original researches or verify the experiments on the physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manures, natural or artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective States or territories.

It is manifest that no one college or station can traverse all the points authorized by the foregoing section.

WHAT SHALL OUR STATIONS DO?

Preliminary to the organization of our station, while waiting for the appropriation, the director called from each professor of the college for a detailed statement of what he would like to do or have done in his division of the department to be organized, and they reported substantially as follows.

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R. R. C. KEDZIE, IN CHEMISTRY AND METEOROLOGY,

desired specially to conduct some analyses of ensilage corn, etc., at the various stages of maturity, to test its value as a food for animals; also to continue his experiments relating to inert nitrogen; also his research as to the effect of tile draining on rainfall and drouth; and finally to have leave to conduct experiments on the pine barrens of Michigan to be referred to hereafter.

PROFESSOR A. J. COOK, IN ENTOMOLOGY,

made the following desirable points:

1. Work out full life history of noxious insects, now known, but imperfectly understood; to study the natural history and habits of new enemies, as they appear from year to year.
2. Experiment with insecticides, and methods to prevent insect destruction.
3. To study beneficial insects, with a hope to increase their value.
4. To develop a race of superior bees, by careful crossing and selection.
5. To experiment as to bee forage, in the hope of discovering plants that will insure a honey harvest at all dates and seasons.
6. To study bee enemies with the aim of discovering remedies.
7. To investigate fungoid diseases of bees and other insects, in the hope to remedy the one, and to make useful the other.
8. Investigation of any practical question relating to insects: as bees vs. grapes, etc.

DR. W. J. BEAL,—BOTANY, FORESTRY.

Proposed Experiments With Grasses.

1. Test in small plats, on soils wet and on soils dry, say six feet square, all sorts of grasses (and other forage plants) from all sources, excepting some which have been tested and found of no value.
2. Test in larger areas, say twenty feet by one hundred and sixty feet or larger, those sorts which seem to be promising, each species by itself.
3. Test a mixture of several of the most promising to compare the results with each sown alone. Perhaps more than one combination.
4. In one or more places sow an acre or more of of a very large number of mixed grasses in drills, 3 or 4 inches apart, and hoe till well established and then watch the changes for some years.
5. Plant together a mixed lot of grasses which produce rootstalks, Poa pratensis, Agropyrum repens, Cynodon, Dactylon, Agrostis vulgaris, etc., and watch the strife and success of each.
6. Sow grass seeds in autumn and others in spring, on good and on poor land, without any other crops, to watch progress.
7. On some old pastures sow seeds of other grasses.
8. Mow one or more plats of permanent grass land six or more times a year, and one or more newly seeded. Analyze same.
9. Mow some plats and keep short all the time in imitation of a closely overfed pasture. Mow others less frequently and less closely in imitation of a pasture in good condition, to see what will be the difference in productiveness and value.

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10. Try to improve one or more sorts by selecting and cultivating.

11. In most or all cases weed the species while young. In most or all cases sow in close drills. Plats of grasses should not be nearer than twenty feet or more of each other on account of the very great difficulty of preventing the mixing. Other crops could be grown between the plats.

12. Recommend grass stations in Michigan, Nebraska, Arizona, Mississippi, and perhaps other places.

13. A careful study of these will soon lead to other experiments not here mentioned or here foreseen.

Proposed Experiments in Forestry.

1. Introduce a very much larger number of species from every part of the world when there appears to be any prospect of success.

2. Plant ten acres with promising mixtures of trees for raising valuable timber; several mixtures including white oak, white ash, shagbark hickory, white pine, the locust, catalpa and some shade enduring trees or shrubs mixed in to shade the ground and keep out the grasses

3. On the sandy plains, as in Crawford county, in Northern Michigan, study and plant all promising trees and forage plants.

4. On the plains plant ten, twenty or more acres to trees.

5. Further than the above I am not prepared to specify; but much other work is in contemplation. Most of this, however, would not require tree planting (additional) but would be in the nature of study and laboratory work.

A few other Promising Experiments.

1. Attempt to select and improve *red* clover.

2. Further experiments to test the effect of bumble bees on the yield of *red* clover.

3. Crossing a number of cultivated races of plants with foreign stock. (See Beal's grasses, p. 307.)

4. Study the structure and physiology of grasses.

5. Study species of grasses as growing and preserved.

6. Improve wheat by selection, cultivation and perhaps by cross breeding.

7. Study some injurious fungi and search for remedies.

8. *Seed testing.* We have laws to regulate the sale of fertilizers, why not for the sale of seeds as to purity and vitality. Have a law making seeds subject to inspection, the seller to guarantee to a certain standard. The Royal Agricultural Society of England has a consulting botanist who has done much good. His duties are largely increasing. As a country grows older this becomes more and more necessary to insure good seeds. (See Beal's grasses, p. 206.)

PROF. SAMUEL JOHNSON, IN AGRICULTURE.

1. Continue the feeding from calfhood to maturity of steers of the different breeds of cattle, under the same conditions, embracing accurate records of kind and amount of food consumed, weights each month, etc., to ascertain: *First*, the comparative growth of animals of different breeds; *Second*. the cost per pound of beef of different breeds. This should be carried on or repeated with at least three different lots of steers.

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2. The feeding of sheep of different breeds in a similar manner to steers.
3. The feeding of swine of different breeds.
4. The growing of the grasses and clovers, *on sufficient acreage*, to test *their value in practical feeding* as well as by chemical analysis.
5. The testing *of a limited number* of new varieties of grains and vegetables, etc., for a sufficient length of time so as to be able to *speak with some certainty* of their adaptation or otherwise, to our latitude and agricultural conditions.
6. Field experiments embracing—
   a. Different methods of preparing soil for crops.
   b. The implements best adapted to the work.
   c. Results from different amounts of seed.
   d. Results from different methods of cultivation.
   e. Testing of various fertilizers with different methods and times of application.

DR. E. A. A. GRANGE, IN VETERINARY.

1. To spay heifers to test the effect on growth and feeding qualities.
2. To spay cows while in milk to test length of time the milk would continue, and its amount and quality.
3. To experiment on horses afflicted with heaves.
4. To study the "germ theory" with relation to contagious diseases of animals, and to experiment as far as possible with the contagious diseases, with reference to their cure and their transmission to other animals.

PROFESSOR BAILEY, IN HORTICULTURE,

in behalf of the State Horticultural Society, presented the following points, in the main formulated by him :

Recognizing the fact that Michigan is one of the leading States in all matters pertaining to horticulture, and appreciating the demands for horticultural experiment made by a very large population directly employed in growing fruits and vegetables, we respectfully ask that the State Board of Agriculture devote to horticultural experimentation its full proportion of the means to be derived from the operation of the Hatch bill. We recommend that land be procured where fruits and other objects of experiment shall be entirely free from molestation. It occurs to your committee that the horticultural experiments should embrace the following subjects:

1. Experiments to originate new varieties of fruits, vegetables and ornamental plants.
   a. By ordinary seedage.
   b. By selection.
   c. By crossing and hybridizing.
2. Improvement and maintenance of old varieties.
   a. By methods of tillage.
   b. By use of various fertilizers.
   c. By changes of stock, crossing and hybridizing.
3. Introduction and testing of new varieties and species.
   a. Domestic cultivated plants.
   b. Wild fruits and ornamental plants.
   c. Japanese and Chinese plants.
   d. Russian plants.

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4. General physiological researches, including influence of pollen, stock and scion, laws of growth and development, etc.

5. Pathological researches; or investigations concerning diseases of plants, especially peach yellows, rotting of plums and cherries, apple scab, tomato rot, potato rot, blackberry and raspberry rust, strawberry rust, grape rots and mildew, gooseberry mildew.

6. Tools and manipulations.

For the purpose of carrying out systematic and continuous investigations upon plant diseases, we recommend that an expert be permanently employed for this purpose.

THE DAIRYMAN'S ASSOCIATION,

of Michigan, who, through its President, Hon. Geo. B. Horton, a member of our Board, put in a claim for recognition, in experiments in butter and cheese making, and in testing the dairy value of different kinds of feed, and the various breeds.

A glance at the foregoing will satisfy the most incredulous, of the importance of the new development of our work, and further that no one station can take up and follow to a satisfactory conclusion more than one-tenth of the topics suggested. It was apparent that we should select what we could best do, and limit ourselves as near as may be to the work selected.

THE PINE BARRENS.

In addition to the subjects above detailed, we have in this State, a special matter of grave public consideration, to wit, the Pine Barrens, so called. A large portion of the lands in fifteen counties in the north half of the lower peninsula, is composed of a light sand which has the repute of being infertile. In fact repeated attempts to bring them into successful cultivation, in some localities, have been failures, while in other localities the success has been so moderate as to discourage settlement. When we consider the large area, which is not less than 5,000 and may reach 10,000 square miles, the problem of their restoration to agricultural possibilities is well worth the amplest expenditure and the most serious consideration. Here is a region as large as the cultivated portion of the valley of the Nile, which for thousands of years has supported a population of six millions, and was for ages the granary of the Roman Empire, abandoned by many to hopeless sterility. The Agricultural College has for years thought there is hope for the redemption of these lands, and, upon the passage by congress of the experiment station appropriation, proceeded at once to the consideration of the problem. We have established five stations, the central and largest, at Grayling, Crawford county, and four smaller and in a sense subordinate ones; one at Walton, Grand Traverse county; one at Baldwin, Lake county; one at Harrison, Clare county, and one at Osceola, Iosco county. The general station at Grayling was selected for the reason that it was thought to be, on the whole, the locality that would best represent the average, —neither the best nor the poorest of the sterile land, —and being in the highest altitude it would contend with one of the prime difficulties, that is the climate. The difficulties are two, the first the fact that frosts come late in the spring and early in the fall, the other the fact that there is but little vegetable matter in the soil. In some localities the fires have burned it all up; in others, notably where pine

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has grown almost exclusively, there has but little accumulated. It has been demonstrated beyond cavil that the soil responds readily to manure and fertilizers; but it is manifest that in the first instance it will be utterly impracticable to purchase fertilizers for 15 counties, and that the early redemption must consist in finding a grass that will grow and thereby increase the fertility from the soil itself and from the atmosphere.

The first problem, then, is to find the grass best fitted for the locality; this will furnish food for stock, and in time the problem will solve itself. To this end the College accepted the donation of the Michigan Central Railroad Company of eighty acres of wild land adjoining the village of Grayling. The whole has been fenced and forty acres cleared, and the plans for the experiment will more fully appear in the bulletin of Dr. Kedzie, who has the principal charge of the Grayling station.

Near this tract five acres of old subdued land has been rented, upon which small plats of nearly 100 varieties of grass have been seeded. The Botanical Department of the College, in charge of Dr. Beal, is gathering from all parts of the world grasses indigenous to those regions; from Siberia, China, Japan, Europe, from Brazil, the Argentine Republic, Chili and Patagonia in South America; also from Mexico and our western plains, so that in the near future the department expects to have in cultivation on the plats at the College and the stations at the north part of the State nearly 300 varieties.

The sub-stations at Walton, Baldwin, Harrison and Oscoda, comprise each from five to ten acres, and they will be used for seeding fewer of the grasses in larger areas, so as to test in more than one locality, and under different conditions the growth of grasses on a larger scale. At Oscoda and Harrison experiments in forestry have also been added. At Grayling the larger forestry work will be made this year, 6,500 trees of 75 varieties having been planted.

I need hardly say that the experiments are commanding the lively attention of the residents of the northern part of the State. After the pine, what?

THE ORGANIZATION OF THE STATION.

February 26, 1888, the department was duly organized under the law, consisting of the following officers:

EDWIN WILLITS, M. A.,	DIRECTOR.
R. C. KEDZIE, M. A., M. D.,	CHEMIST.
A. J. COOK, M. S.,	ZOOLOGIST.
W. J. BEAL, M. A., M. S., PH. D.,	BOTANIST.
SAMUEL JOHNSON, M. S.,	AGRICULTURIST.
E. A. A. GRANGE, V. S.,	VETERINARIAN.
L. H. BAILEY, M. S.,	HORTICULTURIST.
HENRY G. REYNOLDS, M. S.,	SECRETARY AND TREASURER.

Under the rules adopted the officers of the "station" meet once in two weeks to discuss and lay out the work, and by conference make our labors a unit.

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CONCLUSION.

I can only add that each officer of the station entered upon his line of work with a zeal which is an augury of success. In large measure many of the experiments taken in charge by the station had been anticipated by the College, and their transfer to the "station" enables us to proceed at once to the work assigned to us. Still the intervening months since the organization have been essentially devoted to preparation, and our reports must be less meagre than those will be which are to follow. I refer to the separate reports of the officers for more specific information.

EDWIN WILLITS,
Director.

MICHIGAN AGRICULTURAL EXPERIMENT STATION,
June 30, 1888.

REPORT OF THE SECRETARY AND TREASURER.

FOR THE YEAR ENDING JUNE 30, 1888.

March 9th, 1888—To U. S. Treasurer, on account of appropriation for 1st and 2d Quarter	$7,500 00	
April 15th, 1888—To U. S. Treasurer, on account of appropriation for 3d Quarter	3,750 00	
June 30th, 1888—By Disbursements as per vouchers filed in Auditor General's Office		$15,000 00
June 30th, 1888—To Balance due from U. S. Treasury on account of 4th Quarter	3,750 00	
	$15,000 00	$15,000 00

SUMMARY OF DISBURSEMENT ACCOUNT.

Buildings—		
Experimental Feed Barn	$1,200 00	
Horticultural Laboratory Experimental Rooms	1,200 00	
Apiary	600 00	
		$3,000 00
Salaries—		
To 5 heads of departments 200 each, for 4 mo.	$1,000 00	
" 5 assistants	855 98	
" secretary and treasurer	166 67	
" librarian	150 00	
		2,172 65

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Farm Department—		
To labor	$217 69	
" 10 steers 2½ years old in feeding experiment	800 00	
" 7 young steers for second feeding experiment	290 00	
" tools, $73.63; office equipment, $74.86	148 49	
" seeds, $89.04; feed, $103.13; fencing, $45	237 17	
" sundry	36 82	
		$1,730 17
Horticultural Department—		
To labor	$ 98 79	
" plants and seeds	300 48	
" pots, seed bags and labels	119 78	
" microscope and accessories	100 13	
" photographic apparatus	69 75	
" balances, scales and weights	51 42	
" cart, harness, etc.	50 38	
" thermometers, $8.89; sundry, $31.95	40 84	
		831 57
Chemical Department—		
Labor	$46 75	
Physical balance & weights, $367.50; chemical do. $161.70	529 20	
Sundry apparatus, $163.59; chemicals, $130.24	293 83	
Fitting up experimental room, $81.54; sundry, $33.66	115 20	
		984 98
Botanical Department—		
Labor	$109 00	
Tile, $121.00; fencing, $151.65; seeds & grasses, $85.81	358 46	
Microscope and apparatus, $182.11; sundry, $37.15	219 26	
		686 72
Zoological Department—		
Labor	$162 69	
Honey trees, $46.76; fence, $17.25; water pipe, $34.40	98 41	
Tools, hose, etc, $100.55; manure, $17.25	117 80	
Microscope and apparatus, $131.00; scales, $80	211 00	
Insect cases, $123.00; sundry, $24.98	147 98	
		737 88
Veterinary Department—		
Labor	$35 50	
Three horses, $165; wagon, $65; spaying outfit, $63	293 00	
Operating table	40 00	
Sundry apparatus, $67.85; feed, $28; sundry, $28.44	124 29	
		492 79
Dairy Experimentation—		
Traveling expenses of committee of investigation		335 71
Outlying Stations—		
Labor	$1,202 00	
Rent of land, $80; fencing material, $217.34	297 34	
Freight, etc.	51 58	
Traveling expenses, $389.92; seeds and plants, $342.42	732 34	
Fertilizers, $200.50; tools, $166.20	366 70	
		2,649 91
Library—		
Books, $759.82; cases, $73.96; file boxes, $36; freight, labor, etc., $125.35		995 18
Offices—		
Postage and stationery for the departments	$178 90	
Traveling expenses, $58.05; carpeting, $62.07	120 12	
Freight, labor and sundry	54 35	
Cyclostyle and rubber stamps	29 12	
		382 49
		$15,000 00

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This expenditure may be more briefly summarized and classified as follows:

Salaries	$2,172 65
Wages	1,898 89
Buildings	3,000 00
Other property	4,356 53
Permanent improvements	668 18
Seeds and plants	864 51
Traveling expenses	783 68
Miscellaneous	1,255 56
	$15,000 00

INVENTORY.

The following inventory will be seen to aggregate somewhat more than the amount of expenditures for buildings and other property as above shown.

There are several causes for this, among which the fact of the lands being donated instead of purchased is chief. Besides this, the inventory includes stamps, stationery, hay, oats and other articles, which have been included in the item "miscellaneous" in the above table; and finally the increase in the apiary adds its value to the inventory and not to the list of purchases.

Lands donated to the Station—		
80 acres at Grayling, fenced and improved	$1,910 00	
10 " " Harrison, " " "	270 00	
10 " " Oscoda, " " "	120 00	
		$2,300 00
Buildings—		
Experimental feed barn	$1,200 00	
Horticultural laboratory, experimental rooms	1,200 00	
Apiary	600 00	
		3,000 00
Library and offices—Books	$759 82	
4 book-cases, 4 doz. filing boxes, carpet, stationery, etc.	325 40	
		1,085 22
Farm Department—Implements	$73 63	
17 steers for feeding experiment	1,090 00	
Feed and office equipment	168 92	
		1,332 55
Horticultural Department—Implements	$82 50	
Microscope, camera, balances, etc.	265 35	
		347 85
Chemical Department—Sundry apparatus	$156 59	
Chemical and physical balances	529 20	
Horse tools on Grayling farm	146 50	
		832 29
Botanical Department—Microscope and sundry apparatus		186 21
Veterinary Department—Wagon, tools, etc.	269 90	
3 unsound horses for experimentation	165 00	
		434 90
Zoological Department—		
Microscope, balances and insect cases	$354 65	
Apiary, 18 colonies of bees, tools, etc.	254 79	
		609 44
		$10,128 46

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REPORT OF THE CHEMIST OF THE AGRICULTURAL EXPERIMENT STATION.

AGRICULTURAL COLLEGE,
June 30, 1888.

Hon. Edwin Willits, Director of Agricultural Experiment Station:

The establishment of an Agricultural Experiment Station at the College has brought a large addition of work and responsibility to the chemical department. A sub station for experimental work has been established at Grayling, and a farm of 80 acres secured by the generosity of the Michigan Central Railroad Company. Forty acres have been thoroughly cleared and grubbed, plowed and subdued and sown to experimental crops. Full particulars of these experiments on these jack pine lands are given in Bulletin 37, which is reprinted a few pages later in this volume.

Various investigations have been planned bearing more or less directly upon agriculture. Among these is an investigation into

TILE-DRAINING IN RELATION TO FLOOD AND DROUTH.

The alleged influence of tile draining in augmenting floods and aggravating drouths has called for experimental work to determine whether there is good reason to believe that tile-draining causes these bad effects.

Statements on this subject are so persistently repeated in agricultural newspapers that it seemed desirable that the facts in the case should be known, and the public receive some definite information on this subject. The results of this investigation will be given in due time.

IMPROVED INSTRUMENTS.

The apparatus in use in the chemical laboratory has received valuable additions during the year. Two balances for chemical analysis, made by Becker Brothers, have been purchased, making ten analytical balances now in use in the laboratory, besides three assay balances. Becker's physcial balance in glass case with accurate weights has been obtained. This is so delicate that when 5,000 grammes are placed in each scale pan the tenth of a milligramme will turn the scale, or the balance is sensitive to one fifty millionth of its load. This balance will be of great service in original investigations.

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TEMPERATURES AND THERMOMETRY.

The temperature of the soil is one important condition in estimating the capacity of soils for production. Two sets of soil thermometers to measure the temperature of the soil at 24 inches, 12 inches, 9 inches, 6 inches and 3 inches below the surface, have been bought of Green of New York. One of these sets has been put in position at the College, and observations are taken three times a day. The other set of soil thermometers has been placed in the soil at the experimental station in Grayling, where observations are taken at 7 A. M., 1 P. M., and 7 P. M., the same as at the College. A comparison of these soil temperatures may develop interesting facts. The comparison of these temperatures with those of other states will be of scientific interest, and possibly of practical value.

SUN AND SHADE TEMPERATURES.

Observations have been taken for some months on the temperature in sunshine and in shade with a blackened bulb (lamp-black)thermometer and bright (mercurial) bulb thermometer, the observations being taken at 11 o'clock A. M. It is too soon to pronounce on the value of these observations.

TEMPERATURE OF RIVER WATER.

Observations on the temperature of the water in Cedar river have been made on the first day of the month from April to November, to measure the progressive march of the season.

SUNSHINE RECORDS.

A pair of Pickering's Sunshine Recorders has been obtained, and the record of sunshine since last February is preserved, and the results in some form will be published at the close of the agricultural year. These records excite the interest of of all who have examined them. While we may not hope to control the sunshine, it is interesting to know how much he shines upon us, and to compare his favors with those of other regions.

DRAPER'S SELF-RECORDING THERMOMETER.

This instrument has been purchased and suspended at the north door of the laboratory where it has attracted much attention. It does not seem to be as sensitive as the mercurial thermometer, but it gives the curve of temperature for every hour of day and night for seven days before the register sheet is changed. The changes of temperature thus revealed, at a glance, naturally attract attention.

METEOROLOGICAL OBSERVATIONS.

Tri-daily observations of the weather have now been taken at the College for more than twenty-five years. This continuous record of the leading features of our meteorology becomes more valuable with the increasing years.

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INSPECTION OF COMMERCIAL FERTILIZERS.

The sampling and analyzing of commercial fertilizers has been systematically carried forward by this department. Most of the manufacturers cheerfully comply with the law, and protect their agents by paying promptly the fee necessary for a permit to sell. A few manufacturers seem disposed to evade the law, and by paying for a few of their fertilizers, seek to smuggle in other brands of their goods without fully complying with the law. A prompt enforcement of the law would soon cure this evil. Fair dealing with those who obey the law would require its enforcement on all.

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RESULTS OF ANALYSIS OF COMMERCIAL FERTILIZERS IN MICHIGAN FOR 1888.

Manufacturer, and place where made.	Trade name of the Fertilizer.	Where the specimen was selected and name of dealer.	Composition of fertilizers as claimed by manufacturer and as found on chemical analysis.—Percentage estimation.								
				Active nitrogen.	Nitrogen as ammonia.	Phosphoric Acid, P_2O_5				Potash soluble in water.	
						Soluble P_2O_5	Reverted P_2O_5	Insoluble P_2O_5	Total P_2O_5	As oxide K_2O	As s'lph'te K_2O_4
Crocker Chemical Co., Buffalo, N. Y.	New Rival Ammon. Superphosphate	Manufacturer	Claimed	1.23 to 2.05	1.5 to 2.5	8 to	2 to 3	1 to 3	11 to 15	2 to 3	3 to 5
			Found	1.4	1.7	7.2	.78	1.54	10.7	2.11	3.9
Crocker Chemical Co., Buffalo, N. Y.	Ammoniated Bone Superphosphate	C. F. Marshall, Wayne, Mich.	Claimed	2.9 to 3.7	3.5 to 4.5	6 to 8	2 to 4	1 to 2	9 to 14	1.08 to 3.24	2 to 6
			Found	2.90	3.52	7.86	2.23	1.58	11.67	1.93	3.50
Crocker Chemical Co., Buffalo, N. Y.	Potato, Hop & Tobacco Superphosphate	Manufacturer	Claimed	2 to 3	2.5 to 3.5	6 to 8	2 to 4	1 to 2	9 to 14	3.5 to 4.5	6 to 8
			Found	2.23	2.7	6.5	3.9	1.1	11.50	3.8	7.0
Crocker Chemical Co., Buffalo, N. Y.	Buffalo Superphosphate No. 2	C. F. Marshall, Wayne, Mich.	Claimed	.....	.....	10 to 11	1 to 2	1 to 2	11 to 13	.5 to 1	1 to 2
			Found	.....	.1	7.59	2.77	1.02	11.38	1.3	2.0
Crocker Chemical Co., Buffalo, N. Y.	Vegetable Bone Superphosphate	C. F. Marshall, Wayne, Mich.	Claimed	5 to 6	6 to 7	4 to 5.5	1.5 to 2.5	1 to 2	6.5 to 10	6 to 8	11.15
			Found	4.79	5.83	4.37	1.74	1.11	7.20	8.50	16.52
Crocker Chemical Co., Buffalo, N. Y.	Ammoniated Wheat & Corn Superphosphate	Manufacturer	Claimed	2 to 3	2.5 to 3.5	10 to 12		1 to 2	11 to 13	2 to 3	3 to 5
			Found	2.94	3.57	5.67	3.59	1.31	10.58	1.35	2.50
Crocker Chemical Co., Buffalo, N. Y.	Queen City	J. St. John, Utica, Mich.	Claimed	1.5 to 2	2 to 2.5	6 to 8	2 to 4	1 to 2	9 to 14	1 to 2	2 to 4
			Found	1.89	2.29	7.61	2.70	.69	11.0	3.50	4.00
Crocker Chemical Co., Buffalo, N. Y.	Pure Ground Bone	Manufacturer	Claimed	2.9 to 3.7	3.5 to 4.5	.....	.....	.....	25	.....	.....
			Found	3.43	4.16	0	0	0	24	0	0
Mich. Carbon Works, Detroit, Mich	Homestead	J. F. Dubois, Lansing, Mich.	Claimed	1.8 to 2.4	2.25 to 3.15	7 to 10	1	.....	8 to 11	1.48 to 1.90	2.75 to 3.50
			Found	.....	2.46	7.75	2.13	.67	10.55	2.30	4.00
Mich. Carbon Works, Detroit, Mich	Jarvis Drill Phosphate	Manufacturer	Claimed	1 to 2	1.25 to 2.0	7 to 8	.5 to 1.5	2 to 3	9 to 12	.....	.....
			Found	.....	1.48	8.63	2.2	2.91	13.74	0	0
Walton Whann & Co., Wilmington, Del.	Diamond Soluble Bone & Potash	Burdick & Potter, Fentonville, Mich.	Claimed	.....	.....	13	to 15	1 to 3	14 to 18	2.75 to 3.25	5 to 6
			Found	.....	.....	6.79	.....	3.81	.....	3.57	4.59
Walton Whann & Co., Wilmington, Del.	Diamond Soluble Bone	T. S. Barringer & Co., Ionia, Mich.	Claimed	.....	.5 to 1	13	to 15	1 to 3	14 to 18	.....	.....
			Found	.....	.34	7.75	2.51	4.88	14.65	0	0
N. W. Fertilizing Co., Chicago, Ill	Celery Grower	S. R. Wilcox, Lapeer, Mich.	Claimed	2.5 to 3.3	3 to 4	7	to 9	.....	7 to 9	1 to 1.6	2 to 3
			Found	.....	3.54	4.15	4.98	3.15	12.28	2.0	3.60

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N.W. Fertilizing Co., Chicago, Ill.	Garden Vegetable Compound	Stevens & Mott, Benton Harbor, Mich.	Claimed.	2.5 to 3.3	3 to 4	7 to 9			7 to 9	1 to 1.6	2 to 3
			Found.		3.77	4.48	3.10	3.91	10.79	2.0	2.5
N.W. Fertilizing Co., Chicago, Ill.	High Grade Truck Manure	Stevens & Mott, Benton Harbor, Mich.	Claimed.	5 to 6.28	6 to 8	7 to 9			7 to 9	6 to 8	
			Found.	5.95	7.2	4.2	1.8	2.0	8	7.0	
N.W. Fertilizing Co., Chicago, Ill.	* Prairie Phosphate	Stevens & Mott, Benton Harbor, Mich.	Claimed.								
			Found.	2.07	2.72	3.2	1.0	3.84	8.04	0	0
N.W. Fertilizing Co., Chicago, Ill.	Ralston's Bone Meal	Castree Mallery Co., Flint, Mich.	Claimed		2 to 3			10.7 to 13.3	10.7 to 13.3		
			Found.		2.80			11.51	11.51	0	0
N.W. Fertilizing Co., Chicago, Ill.	Fine Raw Bone	T.S. Barringer & Co., Ionia, Mich.	Claimed.	2.5	3			23 to 25	23 to 25		
			Found.		3.5			23.50	23.50	0	0
N.W. Fertilizing Co., Chicago, Ill.	Challenge Corn Grower	T.S. Barringer & Co., Ionia, Mich.	Claimed.	1.6 to 2.5	2 to 3	9 to 11			9 to 11		1 to 2
			Found.	2.51	3.04	6.07	2.85	2.32	11.24		2.0
N.W. Fertilizing Co., Chicago, Ill.	Garden City Phosphate	T.S. Barringer & Co., Ionia, Mich.	Claimed.		2 to 3	9 to 11		2 to 4	11 to 15		1 to 2
			Found.		3.01	6.48	5.63	3.2	15.3	.48	.89
N.W. Fertilizing Co., Chicago, Ill.	National Bone Dust	T.S. Barringer & Co., Ionia, Mich.	Claimed.		2 to 3	10 to 12		7 to 11	17 to 23		
			Found.		1.85	2.56	3.64	6.20	14.13	0	0
N.W. Fertilizing Co., Chicago, Ill.	$26 Phosphate	------	Claimed		1.5 to 2	6 to 8		2 to 4	8 to 12		
			Found.		2.33	3.12	2.06	4.99	10.17	0	0
Thompson & Edwards, Chicago, Ill.	Chicago Bone Meal	Manufacturer	Claimed.								
			Found.		4.2	0	0	21.5	21.5	0	0
Thompson & Edwards, Chicago, Ill.	World of Good Superphosphate	----------	Claimed.								
			Found.		2.21	4.0	3.5	4.5	12.0	0	0

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RECORD OF SOIL TEMPERATURES, AT AGRICULTURAL COLLEGE, FOR THE MONTH OF MAY, 1888.

Date.	7 A. M.					1 P. M.					7 P. M.				
Depth in Inches..	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24
May 1.....	42	43½	45½	47	48	46½	45½	46	46½	47½	47½	48	47½	47	47
" 2.....	39	41½	44	45½	46½	60	51½	47½	46	46½	55½	54½	52	49	47
" 3.....	46	47	48	48	46½	55½	51½	49	48	46½	56	54	52	49	46½
" 4.....	50	50	50	49½	47	54	50	48	46	47	49	50½	50½	50	47
" 5.....	45	46	47	48	47	56½	50½	48½	47½	47	55½	54½	52	49½	47
" 6.....	49	48½	49	49	47½	67	58½	53½	50	47½	64½	61½	57½	53	47½
" 7.....	50½	51½	52½	52½	48½	51	51	51½	51	48½	50	50½	51	50½	48½
" 8.....	46½	47½	48	49	48½	50	47½	48	48	48	52½	51	50	49	48
" 9.....	52	51½	51	50	48	56½	53½	52	50½	48	55½	55½	53½	52	48
" 10.....	51	51	51½	51	48½	57½	55½	53½	51½	48½	60	58	55½	53½	49
" 11.....	55½	55	54½	54	49½	68½	63	58	55	50	64	62½	60	57	50
" 12.....	56	57½	58	57	50½	56	57½	57½	56½	52	50½	54	55½	56	52
" 13.....	47	47	49½	51½	51½	45	46½	48	50	51	45	46½	47	49	51
" 14.....	42½	44½	46	48	49½	45	45	46	47	49	44	45	46	47	49
" 15.....	41	43½	44½	46	48	52	48	47	46½	48	.....	.....	.....	.....	.....
" 16.....	43	43½	45	46½	47½	59	52	48½	47	47½	53	53½	52	50	47½
" 17.....	44½	45½	47	48½	47½	58½	53	50	48½	48	52	52½	52	50½	47½
" 18.....	47	48	49	49½	48	48½	48	48½	49	48	49	49	49	48½	48
" 19.....	45½	46½	47½	48	48	55½	51	49	48	48	55	54	52	50	48
" 20.....	46	47	48½	49	48½	68½	59½	53½	50½	48	62	60½	57½	53½	48½
" 21.....	50	52	53	53	49½	70	61	56	53	49½	66½	64½	60½	56	50
" 22.....	53½	55	55½	55	51	74½	64	59	55½	51½	69	67	63½	59	51½
" 23.....	57	58	58½	57	52	71½	64	59	57½	53	66½	65	62	59	53
" 24.....	57	57½	58	58	53½	72	65½	61	58	53½	67	65½	63	60	54
" 25.....	59	59½	59½	59	54½	62	60	59	58½	54½	61	60½	59½	58½	54½
" 26.....	58½	58	58	57½	54½	71½	64	60	58	54½	67	66	63½	60	54½
" 27.....	59½	60	60	59½	55	65	61½	60	59	55½	65	63	61½	59½	55½
" 28.....	61	60½	60	59½	55½	64	63	61	59	55½	63	63	61	60	55
" 29.....	57½	58½	59	59	55	69	64	61	59	55½	64½	64	63	61	55
" 30.....	56	58	60	60	55½	72	64½	61½	59½	57	66	65½	64	61½	55½
" 31.....	56½	58	59	60	57	64	60	59	59	57	59	60	60	59	57
Means.....	50.4	51.3	52.1	52.2	50.2	60.2	55.8	53.4	52.2	50.4	57.7	57.3	55.5	53.8	50.4

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RECORD OF SOIL TEMPERATURES AT AGRICULTURAL COLLEGE FOR JUNE, 1888.

Date.	7. A. M.					2 P. M.					7 P. M.				
Depth in inches..	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24
June 1....	54	54½	56	57	57	63	60	58	57	56½	58	59	59	58	56
" 2....	53	54	56	56½	56	59	57½	57	58½	56	57½	58	58	58	56
" 3....	55	57	56½	56½	56	71	63½	59	56½	55½	63	62	61	58	55½
" 4....	53	55	56½	57	56	69	62	60	57	55½	66	64	63	60	56
" 5....	57	58½	59	59	55½	71	64	61	59½	56½	68	67	64½	61½	56½
" 6....	64½	63½	63	61½	57	78	70½	66	62½	57½	69	68½	67	64	58
" 7....	58	59½	61	61½	58½	71	63½	61	60	58½	66½	65	63	61½	58
" 8....	58½	59½	60	60	58	76	67½	64	61	58½	71	69½	67	63½	58½
" 9....	64	64½	63½	63	59	72½	68	65½	63	59	70	68½	66½	64½	59
" 10....	67	65	64½	63½	59½	71	68	66	64	60	66	66½	66	65½	60
" 11....	58	59½	61	62	60	78	77½	64	63	60	69	69	67	64½	59½
" 12....	69	61	62½	62½	60	76	68½	65	62½	60	70½	70	68	61	60
" 13....	63	63½	64	64	60½	68	64	63½	63	60½	68	68	66	64	60
" 14....	64	64	64	63	60½	73½	68	66	64	60½	71½	70	68	65½	60½
" 15....	68	67½	67	66	61	84½	76	71	67	61½	77	76	73½	70	62
" 16....	67	68	68½	68½	63	87	77½	72	68½	63½	80½	79	75	71½	63½
" 17....	70½	70	71	69½	64½	91½	81	74½	70	64½	81	80	77½	73½	64½
" 18....	73	73	73	72	65½	93	83½	76	72	66	84	82	79	75	66
" 19....	73	74	74	73	67	92½	81½	76½	73	67	84	82½	81	75½	67
" 20....	73	73½	74	73½	68	94	83	77	73½	68½	84	82½	79½	75½	68
" 21....	73½	74½	74½	74	68½	87	81	77	74	68½	80½	80½	79	76	68½
" 22....	72½	73½	74	74	69	90	81	76½	74	69	82½	81½	79½	76½	69
" 23....	73½	74½	75	74½	69½	88	80½	76½	74	69½	80½	80	78½	76	69½
" 24....	73	73½	74½	74	69½	89	81½	82	74	69½	80½	80	78	76½	70
" 25....	70	71½	73	73	70	72	71	71½	71½	69½	71½	72	72	71½	69½
" 26....	66	67½	69	69½	68½	73½	70	69	68½	68½	73	72	71½	70	68
" 27....	63	65	67	68	67½	68	67	67	67	67½	67½	67	67½	67½	67
" 28....	63½	64½	65½	66	66½	67	66	65½	66	66	66	66	66	66	66
" 29....	62	63½	64½	65	65½	71	66	65	65	65	67	67½	66½	66	65
" 30....	62	63½	64½	65	65	84	74	68½	66½	65	76½	75	72	70	65
Means.....	64.7	65.2	65.9	65.7	62.7	77.6	71.4	68.0	65.8	62.8	72.3	71.6	70.0	65.0	62.7

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RECORD OF SOIL TEMPERATURES AT AGRICULTURAL COLLEGE FOR JULY 1888.

Date.	7 A. M.					1 P. M.					7 P. M.				
Depth in inches..	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24
July 1....	77	70½	68	68	66	90	79	73	69½	66	78	78	75	72	66
" 2....	68	69	70½	70	67	87	77	72½	70	67	78	77½	75½	72½	67
" 3....	69	70	71	70½	67½	87	78	73½	71	67½	80½	79	76½	73	67½
" 4....	74	73	73	72	68	89	80	75½	72½	68	79	79	77	73	68
" 5....	74	74	74	73½	69	95½	83	77	74	69	84½	83	79½	76	69
" 6....	72	73½	74½	74	70	77	75½	74½	73	70	76	75	74½	73½	69½
" 7....	72½	72½	72½	72	69½	93½	82	75½	72½	69½	81½	80	77	74	69
" 8....	64	71	72½	73	70	69½	69½	70½	71	70	71	70½	70½	70½	69
" 9....	68	69	69½	70	68½	69	69	69	69	68½	68½	69	69	69	68
" 10....	62½	65	66½	67½	67½	79½	72	69	68	67½	73½	73½	72½	70	67
" 11....	69	69½	70	69½	67½	85	76½	72½	70½	67½	79½	77½	75½	72	67½
" 12....	70	71½	72	71½	68	68	69½	70½	70½	67½	66	67½	68½	69	68
" 13....	61½	64	66	67	67½	82	72½	68½	67	67½	73	72½	71	69	67
" 14....	64½	66	67½	68	67	73½	70	68½	67½	67	72½	71½	70½	69	66½
" 15....	65	66	67½	68	66½	80½	74	70	68	67	76	75	73	70	66½
" 16....	66	67	68½	69	67	78	73	70	68	67	75	74	72½	70	67
" 17....	67½	68½	69½	69½	67	78	75	72½	69	67	76	74½	73	70½	67
" 18....	70	70	71	70	67½	80	75½	72½	70½	67½	77	76½	74	71½	67½
" 19....	67½	69	70½	70½	68	78½	74½	72	70	68	74½	74	73½	71½	67½
" 20....	67½	68	69½	70	68	83	76	71½	70	68	79	78	75	72	68
" 21....	78	69½	71	71	68	80½	76	72½	70½	68	78½	77	75	72	68
" 22....	72	71½	71½	71	68	73	72½	72	71	66	74	73½	72½	71	68
" 23....	67½	68½	69½	70	68	85½	77½	74½	70½	68½	81½	80	77	73	68
" 24....	68½	70½	72	72	68½	85	78½	74	72½	68½	82	80	77	73½	68½
" 25....	68½	70½	72½	72½	68½	83½	77	74	72	69	80	78	75	72	69
" 26....	60	72½	73½	73	69	70	70½	71	71½	69	70	71	71	71	69
" 27....	68½	69	69½	70	68½	74	71	70½	69½	68½	73	72½	72	71½	68½
" 28....	66	68	68½	69	68	82½	76	72	69½	68	76	76	75½	73½	68
" 29....	70	70½	71½	71½	68½	86	80	75	73	68½	81	79	77½	75	68½
" 30....	73	74	74	74	69	84	78	75	73½	69	83½	82	79½	76½	69½
" 31....	75	75	76	75	70	77	75½	75	74	70	78½	78	77	75	70
Means.....	68.6	69.9	70.8	70.7	68.1	80.7	75.8	72.4	70.5	68.1	76.7	75.9	74.8	72.0	67.6

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RECORD OF SOIL TEMPERATURES AT AGRICULTURAL COLLEGE FOR AUGUST, 1888.

Date.....	7 A. M.					1 P. M.					7 P. M.				
Depth in inches	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24
August 1.	68½	70	72½	73	70	88	83	78	74	70	70	70½	71	71½	70
" 2.	70	72	73½	73½	70	70	72	72	72½	70	70	70½	71	71½	70
" 3.	68½	69	69½	70	69½	89	82	74	70	69	76	75½	74	72½	69
" 4.	72½	72½	72½	72	69	80	77	74½	72½	69½	76	76	76	74½	69½
" 5.	71½	71	72	72½	69½	87	81	76½	73½	70	82	81	79½	76	70
" 6.	73	74	75	74½	70	77	76½	75½	74	70	75	75½	75½	74½	70
" 7.	70	71	72	72½	70	76	75	73½	72	70	72	73	73½	72½	70
" 8.	68	69	70	70½	70	77	74	71½	70½	69½	75	75	74½	72½	69½
" 9.	66	68	69	70	69½	76	73	70	69½	69	75	75	74	72	69½
" 10.	64	66½	68½	70	69	75	72	70	69	69	75	75	74	72	68½
" 11.	64	66	68	69½	68	73½	70	69	69	69	70	71½	71	70	68½
" 12.	66	67	68	69	68½	69	68	68	68½	68	68½	69	68	68½	68
" 13.	63½	64½	65½	66½	67½	64	64½	65½	66	67	65	65	61½	66	67
" 14.	58½	60½	63½	64½	66½	74½	69½	66½	65	66½	70	71	70	68	66
" 15.	63½	64½	66	67	66	77	72½	69½	67½	66½	73	73	71½	70	66½
" 16.	68	68	69	69	66½	70½	70	69	68½	67	70	70	70	69	67
" 17.	70	69½	69	69	67	79	74½	71½	69½	67	77	76	74	71	67
" 18.	70	69	69½	69½	68	80	75	72	70	67	77	76½	74	71	67
" 19.	69	69	70	70	68	80½	75½	72	70	68	78	77	75	72	68
" 20.	69	69	71	71	68½	81½	76	72½	70½	68½	78½	77½	75	72½	68
" 21.	70	70½	71½	71½	68½	77½	74½	72	72	68½	75	74½	73½	72	68½
" 22.	65½	67	69	70	68½	79½	73½	70½	69½	68½	76½	75½	73½	71½	68½
" 23.	64	65½	68	69½	68½	78½	73	70	69	68½	76	74½	72½	70	68
" 24.	66	68	69½	70	68	80	74½	71	69½	68	77	75½	73	71	68
" 25.	66½	69	70	71	68	81	75	71½	70½	68½	78	76½	74	72	68½
" 26.	70	70½	71½	71½	68½	82	76	73	71½	68½	79	77	75	72½	68½
" 27.	70½	72	73	72½	68½	83½	76½	73½	72	69	78	76½	74½	72½	69
" 28.	64	68	70	71	69	82	74	72	72	69	78	75	72	71	69
" 29.	65	67½	69½	70	68½	75	71	70	69	68½	77	74½	70½	70½	68½
" 30.	68	70	71	70	68	76½	71½	70½	70	68	79	76	73	71	68½
" 31.	70	71½	72	71½	68½	71½	71	71	71	68½	71	71	71	70½	68½
Means.....	67.4	68.6	70.0	70.4	68.5	77.6	74.3	77.6	70.3	68.5	74.1	74.7	72.7	71.3	68.4

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RECORD OF SOIL TEMPERATURES AT AGRICULTURAL COLLEGE FOR SEPTEMBER, 1868.

Date.	7 A. M.					1 P. M.					7 P. M.				
Depth in inches..	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24
Sept. 1....	62	65	68	69	68	74½	½	67½	68½	68	72	71½	70	69	68½
" 2....	61½	65	67½	68½	67½	74½	68½	67½	68	68	74	72	70	68½	66½
" 3....	64	66½	68½	69	67½	65	70	68	68	67½	76	73½	71	69	67½
" 4....	66	68	69½	69	67	70	69	68½	68½	67½	70	70	69	68½	67
" 5....	58	62½	66	67½	67	70	65	65	67½	67	70	70	67½	67	66½
" 6....	58	62	65	67	66½	69½	64½	64½	66	66½	71	69	67	66	66
" 7....	62	64	65½	66½	66	71	66	65½	66	66	74	71	68½	66½	66
" 8....	66	67	68	67½	66	74	70	68	67½	66	68	69½	69	68	66
" 9....	60½	64	66½	67	66	75½	70	67	67	66½	73	72	70	68	66½
" 10....	60	63½	66½	67½	66	74	68	66½	66½	66½	71	71	69½	67½	67
" 11....	65½	67	68	68	66	70½	72	68½	68	66½	76½	74	71	68½	66½
" 12....	67	69	70	69½	66½	73	70½	69½	69	66½	70½	70½	70	69	66½
" 13....	59	63½	66½	67½	66½	72	66½	66	66½	66½	70	70	68	67	66
" 14....	57	61½	65	66½	66	69	64½	64½	65½	66	69	68	67	66	65½
" 15....	60	63	65	66	65½	72	67½	65	65	65½	70½	69	67	66	65½
" 16....	61	63	65	65½	65	64½	64	65	65½	65	62½	64	65	65	65
" 17....	58	60	62	63	65	66½	63	62	62½	64½	63½	63½	63½	63½	64½
" 18....	59	60	62	63	64	59½	61	61½	62	64	58½	60	61	61½	63½
" 19....	56½	58	59	61½	63	60	59½	60	60	63	60	61	61	61	62½
" 20....	55½	57½	58½	59½	62	65	60½	59	59½	62	63	62	61½	61	62
" 21....	56½	58½	60	60½	62	68	63	61	60	62	64	64	63½	62½	62
" 22....	57½	59	60½	61	62	65	62	62	61	62	63	63	62½	62	62
" 23....	59	60	61	61½	62	63½	61	60½	61	61½	62	62½	62½	62	62
" 24....	57	58½	60	61½	61½	64	63	61	61	61½	65	65	64	63	61½
" 25....	57	59	61	61½	61½	65	62½	61	61	61½	60	62	61	63	61½
" 26....	56	58	60	61	61½	57½	58½	59½	60	61½	54½	56½	59	59½	61½
" 27....	52	54	56	58	60	54½	55½	56½	57½	60	54	54½	56	57	60
" 28....	48½	50½	53½	55½	59½	52	52	53	55	59	51	52½	54	55	59
" 29....	47½	49½	51½	54	58½	52½	51½	52	53½	58	51	52	53	54	57½
" 30....	47½	49	51	53	57	50½	51	51½	53	57	50	51	52	53	56½
Means....	58.5	60.9	62.5	63.9	64.1	66.2	63.6	63.1	63.0	64.2	65.2	65.4	64.7	64.0	64.1

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SUMMARY OF SOIL THERMOMETER RECORD AT THE STATE AGRICULTURAL COLLEGE FOR 1888.

Depth.	7:00 A. M.	2:00 P. M.	7:00 P. M.	Mean.	Difference.
May:					
3 inches	50.40	60.21	57.70	56.10	.....
6 "	51.345	55.80	57.28	54.81	1.29
9 "	52.145	53.40	55.46	53.34	1.47
12 "	52.18	52.20	53.81	52.	1.61
24 "	50.24	50.37	50.42	50.34	2.39
June:					
3 "	64.68	77.63	72.80	71.54	.....
6 "	65.21	71.40	71.61	69.41	1.13
9 "	65.88	68.05	70.00	67.98	1.43
12 "	65.75	65.83	67.68	66.42	1.56
24 "	62.78	62.78	62.74	62.75	3.67
July.					
3 "	68.60	80.68	76.68	75.33	.....
6 "	69.29	75.27	75.89	73.68	1.64
9 "	70.76	72.40	74.26	72.47	1.21
12 "	70.73	70.52	72.00	71.08	1.39
24 "	68.10	68.10	67.63	67.94	3.04
August:					
3 "	67.36	77.60	74.15	73.04	.....
6 "	68.64	74.31	74.67	72.54	.50
9 "	70.02	71.56	73.75	71.44	1.10
12 "	70.43	70.30	71.31	70.68	.76
24 "	68.50	68.54	68.42	68.49	2.19
September:					
3 "	58.50	66.19	65.23	63.64	.....
6 "	60.87	63.64	65.41	63.31	.33
9 "	62.55	63.14	64.71	63.47	—.16
12 "	63.87	63.03	64.05	63.65	—.18
24 "	64.07	64.19	64.15	64.14	—.49

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RECORD OF SOIL TEMPERATURES AT GRAYLING, MICH., FOR MONTH OF JUNE, 1888.

Date.	7 A. M.					1 P. M.					7 P. M.				
Depth in inches..	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24
June 1....	44½	48	50½	52	52½	55	52	50½	51	52	54½	54	53	52	51½
" 2....	47	49½	50½	51½	51½	56½	52½	51	51	51½	58	56½	54	53	51
" 3....	45	48½	50½	51½	51½	63½	55½	52	51	51½	63½	61½	57½	55	50½
" 4....	50	54	54½	54	52	68	60	57	53½	52½	67½	64½	60½	57½	52½
" 5....	53½	54½	56	55½	52½	63½	60	56	54	53	66	63	60	57½	54
" 6....	61½	61	60	59	54½	60	60	59½	57	55	56	58	58	57½	55
" 7....	50	53	54½	55	54½	54½	55½	56	60	67	65	63	60	58	54
" 8....	55	56	57	57	54	68½	61½	58½	57	55	69	66	62½	60	55
" 9....	62½	62½	62½	60	55½	73½	65	64	60	57½	72	69	66	64½	57
" 10....	63½	64	63½	62½	58	66½	65	63½	62	58	59½	65	62½	62	58
" 11....	51	53½	56½	57½	57½	73	63½	59½	57½	57½	70	68	64½	62	57
" 12....	51½	59	60	60	58	72	65	61½	60	57½	70	67	65½	63	58
" 13....	62	62½	63	61½	58½	67	63	62½	61	58½	66½	65	63	61½	58½
" 14....	58	59½	59½	60	58½	64	62½	62	61	58½	69½	68	65½	63½	58½
" 15....	63½	64½	64	65½	61½	85½	75½	69	65	61½	84½	80½	75½	71	62
" 16....	68	69	65	66	63	88	75	70	64	63	88½	81	76	72	63
" 17....	71	71	69½	68	63½	87	78	73½	69½	64	85	82	77½	73½	64
" 18....	69½	71	71½	71	65½	86½	78½	73½	71	65½	88	81	78	74½	66
" 19....	71½	71	71½	71½	67	85½	78½	74½	71½	67	75	76	75	73½	67
" 20....	69	68½	69	69½	67	81½	76	72	70	67	88	81	77	74	66
" 21....	72	72	82	72	67½	79	75½	73½	72	68	82½	80	77	74	67½
" 22....	70	71	71½	71½	67	86½	79	74½	72	68	83	81½	78½	75½	67½
" 23....	70	71	72	72½	68½	86½	78	74½	72	68	83	81	78½	75½	68½
" 24....	72½	72	72	73	69½	85	78½	74½	73	69	81	80	76	75½	69
" 25....	70	71½	71	73	69	75	75	73	72	69	75	75	73½	72½	69
" 26....	63	65½	67½	68½	68½	72	69½	67½	68	68½	74½	74	73½	70	67
" 27....	62	64½	66	67	67	76½	67	67	66½	66½	69½	69	68	67½	66½
" 28....	63	64½	65½	66	65½	76	69½	67	66½	65½	76½	74½	71½	69½	65½
" 29....	65	64½	66	66	66	79	69½	67	66½	66½	80½	78	74	71	65½
" 30....	67½	69½	69½	66	66½	80	74	69½	69½	66½	78	76½	74	72	67
Means.....	61 8	62.9	63.7	63.5	61.0	70.7	67.9	65.2	63.5	61.3	72.8	71.3	68.5	66.1	61.0

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RECORD OF SOIL THERMOMETERS AT GRAYLING, MICH., FOR MONTH OF JULY, 1888.

Time.	7 A. M.					1 P. M.					7 P. M.				
Depth in inches..	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24
July 1.....	64	67	68⅛	69	67	79	72½	70	69	67	80⅛	79	75	72½	67
" 2.....	69	70	70⅛	70⅛	67	68	71	72	74	80	79	77⅛	75	73	68
" 3.....	70	74	72	72⅛	67	79	70	70	70	68	79	76	73	71	68
" 4.....	70	71⅛	72	72	69	85	83	78	73	69	84⅛	82	78⅛	75⅛	69
" 5.....	69⅛	72⅛	72	73	69	82	77	74	72⅛	69	84½	80	77	75	69
" 6.....	68	70⅛	72	73	71	78⅛	75	72⅛	72⅛	71	85	81	77	72	71
" 7.....	70	72	73	72⅛	69⅛	77	74	72⅛	72⅛	69⅛	78	78	75	73	69⅛
" 8.....	66	67	78	69	69½	66	68	69⅛	70	69⅛	67	67⅛	67⅛	68	68
" 9.....	61⅛	64	65⅛	66½	67	70	70	66	66⅛	67	79	77	73½	70⅛	67
" 10.....	63	66⅛	68	68⅛	67	79⅛	71	68⅛	68	67	75⅛	78⅛	73⅛	70⅛	67
" 11.....	68	68	68	68	68	78⅛	72	70⅛	69	67	75	75	78	71	67⅛
" 12.....	67⅛	68⅛	68	66	62	66⅛	65	65	66	67	66	67⅛	67	66⅛	66⅛
" 13.....	54⅛	58	65	66	67	74⅛	67⅛	64	63	65	75	66⅛	65	63	65
" 14.....	56	60	62½	64	64⅛	74⅛	67⅛	64⅛	63⅛	64⅛	74⅛	76	68⅛	66⅛	64⅛
" 15.....	60	63⅛	64⅛	65⅛	64⅛	79	71	67	65⅛	65	77⅛	75	72	69⅛	64⅛
" 16.....	60⅛	64⅛	66	67	65⅛	76⅛	70	67	67	65⅛	75⅛	74	71	69	65⅛
" 17.....	65	67⅛	67⅛	67⅛	65⅛	70⅛	68	67⅛	67	65⅛	70	70	69	67	65⅛
" 18.....	60	63	64⅛	67	65	77⅛	77	71	67⅛	65	73⅛	72	70½	68⅛	65
" 19.....	60	63	61⅛	65	65½	69	66⅛	65⅛	65	65⅛	68	68	67	66	65
" 20.....	60⅛	62	63	64	65	80	70	66⅛	65	65⅛	79	70	70	69	65
" 21.....	60	64	66	66⅛	65⅛	78⅛	70	67⅛	66⅛	65⅛	74⅛	72⅛	70⅛	68⅛	65
" 22.....	63	67⅛	67⅛	67⅛	66	71	67⅛	67⅛	67	66	75	74	70⅛	69	65⅛
" 23.....	63	65⅛	67⅛	67⅛	66	71⅛	69⅛	68	67	66	71⅛	70	68⅛	68	65⅛
" 24.....	58⅛	62⅛	64⅛	65⅛	65⅛	77⅛	68⅛	68⅛	65⅛	65⅛	76⅛	69	67	66⅛	65⅛
" 25.....	60	64	77	66⅛	65⅛	78⅛	71⅛	67⅛	66⅛	65⅛	77⅛	75⅛	72	69⅛	65⅛
" 26.....	66⅛	67	67⅛	68⅛	66	73	70	68	67⅛	65⅛	71	69	67	67	66⅛
" 27.....	60	64	65	66	66⅛	73⅛	68	68⅛	66⅛	66	76	75	72⅛	70	65⅛
" 28.....	65	64	66	67	66	77⅛	71⅛	67⅛	66	66	78	76	71⅛	69	65⅛
" 29.....	65⅛	67⅛	68⅛	68	66⅛	65⅛	67⅛	68⅛	68⅛	66	82	78⅛	75	72	66
" 30.....	70⅛	71⅛	71⅛	71	67	81	78	73⅛	71	67⅛	85	82	78	74⅛	68
" 31.....	72	73	73⅛	73	69	73	73	73⅛	73	69	68	70	71	71	68⅛
Means...	63.9	66.5	68.3	68.3	66.8	75.5	71.1	69.0	68.0	66.8	75.5	74.1	71.8	68.7	66.6

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RECORD OF SOIL THERMOMETERS AT GRAYLING, MICH., FOR MONTH OF AUGUST, 1898.

Date.	7 A. M.					1 P. M.					7 P. M.				
Depth in inches..	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24
August 1.	55	60	64	66	68	80	70	66	65	67	77	75½	72½	70	66
" 2.	64½	67	68	68	67	66	66	66½	67	66	68	68	67	67	66
" 3.	63½	64½	65½	66	66	78	71	67½	66½	66	78	75	72	69½	65½
" 4.	67½	69	69½	69	66½	74	71	69½	68½	66½	75	73	71	69½	66½
" 5.	67½	65	66	66½	62½	81	74	79	69	67½	80½	77	73½	71½	66½
" 6.	65	63½	67	68	67	76	71	68½	67½	67	72	72½	71½	70	66½
" 7.	64½	66	67	67	67	76½	71½	68½	67½	66½	67	70	70	69	66
" 8.	54½	58½	62½	64½	66	72½	66	63	64½	65½	68	69	68	66½	65
" 9.	53	60½	66	64	65	70	64	64	63	64½	68	68	67	64½	65
" 10.	73	60½	66	64	65	77	69	64	63	64½	69	69	68	66	64
" 11.	59	63	63½	64½	64½	64½	64½	62	63	64	63	64	63½	63	64½
" 12.	70½	63½	60½	60	62½	69	67½	65½	64	62½	73½	71½	68½	65½	63½
" 13.	52½	56½	59½	64½	62½	74½	66½	62½	62½	63½	73½	71½	68½	65½	63½
" 14.	58½	61½	63½	64	63	71½	64½	63½	63	63	70½	69	67	66	63
" 15.	64	64½	64½	64½	63	69½	67½	65½	64½	63	68	67½	66½	65½	63
" 16.	70	71	69	68	64	68	67	65	65½	63½	65	65	65	65	63½
" 17.	60	63½	64½	65½	64½	74½	69½	66½	65½	64½	69½	70½	69	68½	64½
" 18.	51½	57½	61	64½	64½	78	68	64	64	64	74	73	70	67½	63½
" 19.	60	63	64	65	64	80½	73	68	65½	64	74	74	71½	69	64
" 20.	59	63	64	65	65	79	71	67½	65½	64½	77	74	71½	69½	64½
" 21.	65	64	65	65	65	75	70	67	66½	65	70	71	70	67	65
" 22.	67	60½	63	64½	65	69½	60	62½	64	64½	59	60	62	63	64
" 23.	58	62	63½	64	64	70	64	62½	63	64	74	70	68½	66	63½
" 24.	76	70	66½	65½	64½	77	75	71½	68½	64	65	67	67½	67½	65
" 25.	68	72	68½	67½	65½	70	70	68	67	65	70	71	70	69½	66
" 26.	68	70	70	69½	66	80½	75	71	69½	66½	77	76½	75	71½	66
" 27.	63	66	68	68½	67	75	69½	67½	66½	66½	75½	74	71	69½	66½
" 28.	76	62½	65	67½	66½	73	67	65	65½	66	75	72½	70	67½	65½
" 29.	62	65	66	67½	65	75	70	67	66½	65½	75	74	70½	68	65
" 30.	58½	63	66	66½	65½	73	67	65½	65½	65½	76½	74	70	68	65
" 31.	60	64	66	67	65½	71½	67	66½	66	65½	68	68	68	66	65
Means.....	63.0	63.9	65.3	65.8	65.3	73.8	68.5	66.5	65.6	65.0	71.5	70.8	69.2	67.5	64.5

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RECORD OF SOIL THERMOMETERS AT GRAYLING, MICH., FOR MONTH OF SEPTEMBER, 1888.

Date.	7 A. M.					1 P. M.					7 P. M.				
Depth in inches..	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24
Sept. 1....	51⅛	56⅛	60	62	64⅛	71	68⅛	61	67	64	58⅛	58⅛	61	62⅛	64⅛
" 2....	69⅛	69	66⅛	65	63⅛	56	65	62⅛	63	63⅛	73	64⅛	62⅛	62⅛	63
" 3....	65	62⅛	62⅛	63⅛	64⅛	65	62	62⅛	63	63⅛	69	63	62	62	63⅛
" 4....	65	63	63	63	64	65	62	62⅛	63⅛	64	63	63	63	63	63⅛
" 5....	48	53⅛	58⅛	61⅛	63⅛	69⅛	61⅛	58⅛	59	63	70	65	60	63	63⅛
" 6....	50	53⅛	58⅛	60	61⅛	67	65⅛	63	61⅛	61	67	56	59	60	61
" 7....	67	59⅛	59⅛	60	61⅛	69⅛	68	64	61⅛	61⅛	66⅛	62	62⅛	62⅛	61⅛
" 8....	73⅛	67⅛	64	63⅛	61	70	69	66⅛	64⅛	61⅛	55	58⅛	60⅛	62	62
" 9....	73	66	62	61⅛	62	74⅛	71⅛	67	64⅛	62⅛	63⅛	64	64⅛	64⅛	62⅛
" 10....	74	65	62	62	62	74	71	67⅛	64⅛	62	64	64	64	64	62
" 11....	63	64	64	64	62⅛	68	66	64⅛	64	62⅛	70	68	66	64⅛	62
" 12....	67⅛	63⅛	62⅛	63	63	57⅛	60	61⅛	62⅛	62	56	58	60	61	62
" 13....	49	52	55⅛	58	61	60	58	59	60	61	61	54	56⅛	59	61
" 14....	51	53	55	57	60	62	57	55	56⅛	60	65	55	59	58⅛	59
" 15....	49	55⅛	56	57⅛	59	64⅛	58	57	57	59	61	54	58	58	59
" 16....	59	59	59	59⅛	59	60	59⅛	59⅛	59⅛	59	59	59⅛	59⅛	59⅛	59
" 17....	55	56⅛	57	58	59	64⅛	60	58⅛	58	59	58	56	58	58	59
" 18....	55	57	57	58	59	57	57⅛	57⅛	58	59	56⅛	57⅛	58	58	59
" 19....	52	53⅛	54⅛	56⅛	57⅛	52	53⅛	55⅛	55⅛	57⅛	57	57	56	56	57⅛
" 20....	51	53⅛	54	55	57⅛	50	56	55	55	57	50	52⅛	54	55⅛	57
" 21....	62⅛	58	55⅛	55	57	62	61	59⅛	57⅛	57	61	59	58	57	57
" 22....	56	56	55	56	57	56	56	58	55	57	58	57	57	57	57
" 23....	56	56	56	56	57	57	57	59	55	57	58	57	57	57	57
" 24....	49⅛	52	54	55⅛	57⅛	67	66⅛	63	60	57⅛	70	66	64	60	57⅛
" 25....	50	54	56	57⅛	58	75	70	65	63	58	69⅛	66⅛	63	61	58
" 26....	52	55⅛	57	58⅛	58	54	55⅛	56	57	58	54	55	56	56	58
" 27....	45⅛	49⅛	51⅛	53	54	49⅛	50½	51⅛	52⅛	54	49	47⅛	47⅛	46	54
" 28....	45	48	50	51	54	49⅛	49⅛	50	50½	54	47⅛	49⅛	50⅛	51	54
" 29....	46	45	45	46⅛	53⅛	47	48	47⅛	47⅛	53	47	47⅛	47⅛	47⅛	53
" 30....	40⅛	42⅛	44⅛	46	51	47	46⅛	46	46	51⅛	47	45	46	46	50⅛
Means....	56.6	56.4	57.2	58.1	59.4	61.4	60.2	59.0	58.9	59.3	60.1	57.7	58.3	58.3	59.3

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SUMMARY OF OBSERVATIONS ON SOIL TEMPERATURES AT GRAYLING, MICHIGAN FOR 1886.

Depth.	7 A. M.	1 P. M.	7 P. M.	Mean.	Difference.
June:					
3 inches	61°.28	70°.72	72°.83	68°.28	
6 "	62 .88	67 .95	71 .32	67 .38	0°.70
9 "	63 .73	65 .17	68 .53	65 .81	1 .57
12 "	63 .48	63 .55	66 .06	64 .37	1 .44
24 "	61 .05	61 .38	61 .05	61 .44	2 .13
July:					
3 "	63 .92	75 .49	75 .52	71 .64	
6 "	66 .52	71 .10	74 .06	70 .59	1 .05
9 "	68 .28	68 .97	71 .79	69 .68	.91
12 "	68 .26	68 .02	69 .74	68 .67	1 .01
24 "	66 .80	66 .77	66 .60	66 .72	1 .95
August:					
3 "	63 .02	73 .76	71 .47	69 .42	
6 "	63 .91	68 .52	70 .80	67 .74	1 .68
9 "	65 .26	66 .47	69 .16	66 .96	.78
12 "	65 .76	65 .58	67 .45	66 .26	.70
24 "	65 .80	65 .02	64 .55	64 .96	1 .30
September:					
3 "	56 .57	61 .37	60 .13	59 .36	
6 "	56 .43	60 .16	57 .66	58 .08	1 .28
9 "	57 .2	59 .05	58 .35	58 .20	- .12
12 "	58 .12	58 .98	58 .35	58 .47	- .27
24 "	59 .42	59 .32	59 .27	59 .34	- .87

Respectfully submitted,

R. C. KEDZIE,

Chemist, Exp. Station.

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REPORT OF THE ENTOMOLOGICAL DEPARTMENT.

President Willits:

DEAR SIR,—I respectfully submit the following report of work and plans in my department of the Experimental Station:

For many years I have carried on experiments with insecticides, as my college duties would permit. As insects are so seriously destructive, and are becoming more and more so, I thought these experiments should be continued. In so fruitful a field there cannot be too many workers. It is contemplated in this line to try experiments looking to the prevention of insect ravages, and also to keep watch for any insects new to our State that may come among us, and to note new habits acquired by indigenous or native insects, that threaten the interests of our farmers and fruit growers. To know our insect enemies, and to know how to thwart them, is very important, and to gain such knowledge, and to disseminate it will be the earnest endeavor of those in control of this department.

Owing to the fact that my assistant, Prof. C. P. Gillett, was called to Iowa very early in the year to take charge of the entomological work of that State, our work in this direction was seriously interfered with; yet experiments which were thought important and desirable were performed, and the results were given in a bulletin which was issued early in October, and will be appended to this report.

NEW INSECT RAVAGES.

In the State Horticultural Report, 1883, p. 155, I described with illustrations a new enemy to the strawberry—a weevil or snout beetle—*Anthonomus musculus Say.* This weevil works on the young fruit, and the ravages by it that year in our northern peninsula were quite alarming. The next year, strangely enough, this insect attracted attention by its ravages in Long Island, and other places in southeastern New York. This season W. L. Coonley, Pontiac, Michigan, complains that these weevils are doing him no inconsiderable harm. This weevil (Fig. 1) is very small—only 1–10 of an inch long. It is reddish, with a black head and thorax.

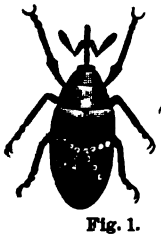

Fig. 1.

I have never had opportunity to try experiments to destroy this pest, but from experiments tried on the plum curculio, which are fully described elsewhere in this report. I should expect that a very dilute mixture of London purple and water would prevent their work. This could be used as dilute as one pound poison to two hundred gallons of water. This is used so short a

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time before the fruit ripens, that even though so dilute it is not well to recommend it. The other preparation, common land plaster, mixed with crude carbolic acid—one pound of the acid to fifty pounds of the mineral—would be safe and I do not think it would scent the berries so as to damage them. I should expect, or hope at least that it would prevent the ravages of this new enemy of the strawberry.

A NEW CORNSTALK ENEMY.

For the past two seasons the corn in the northern counties of our State has been, in some localities, quite seriously injured by a borer which much resembles our cut worms. The larva, which bores longitudinally along the centre of the young growing stalk, kills the plant. This larva is striped much like the army worm. It is gray in color, and striped with darker lines. One moth which I reared proves to be *Helotropha Atra Grt.* The moth (Fig. 2) is quite dark and marked with light spots as shown in the figure. It looks much like some of the species of Agrotis. I see no way to combat this enemy, other than to use the methods recommended to destroy the cut worms.

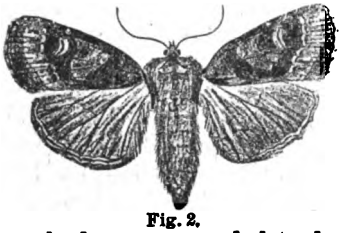

Fig. 2.

A GREEN CORN ENEMY.

In several portions of the State green corn in the ear has been quite badly eaten by one of our common beetles. *Euphoria inda Linn.* This is a yellowish brown beetle. The female (Fig. 3) is about three-fourths of an inch long, the male (Fig. 4) smaller. Both are specked with dark spots. The female has four white specks on her wing covers as seen in figure. The beetle flies with a loud hum, when it might be mistaken for a bumble-bee. While I have never before heard of any serious damage from this beetle to corn, I have known it to bore into ripe autumn fruit like the luscious fall pippin and our autumn pears; and have heard frequent complaints from our west shore fruit men, that the same habit prevails respecting this insect and the peach. It is also reported that this beetle bores into plums and grapes. I know not the life history of this beetle; so far as I know, it has never been worked out. If we may judge from the past, and we have no better way to judge of the future, we may rest in hope so far as the ravages of this beetle are concerned. I have known it to be a not uncommon insect among us for years, and yet it has rarely done any considerable damage, even to apples and peaches.

Fig. 4.

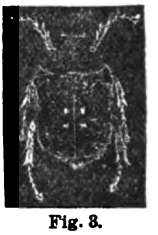

Fig. 3.

THE MOLE CRICKET.

For some reason, possibly because of the recent dry years, and the partial failure of the potato crop, many have recently planted their potatoes on low, damp, often mucky ground. Potatoes thus planted have been quite seriously

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attacked, especially in Oakland county, by the large, curious mole cricket, *Gryllotolpa borealis Burm.* I have also received similar reports of injury from this large cricket (Fig. 5) from northern Ohio.

Fig. 5.

The name Gryllotolpa means mole cricket; the entire name Northern Mole Cricket. As will be seen by figure it is well prepared by its short possorial anterior legs to dig, and form its underground burrows. Dr. Harris speaks of it as burrowing in low marshy ground, and feeding on roots of grass. Prof. S. H. Scudder says it is very widely distributed in the northern United States. Prof. C. H. Fernald in his Orthoptera of New England repeats what Dr. Harris says of the habits and food of this species, but I find no report of this insect as an enemy of the potato. Yet as the tuber of the potato is only an enlarged root, it is not strange that this insect mole should try its quality. The wire worms do the same thing. These elater beetle grubs usually eat roots of grass, corn and our cereals, but frequently they attack our potatoes and do much mischief.

One year our students took quite a number of mole crickets in one of the rooms on the first floor of our Wells Hall, which is at least eight feet above the ground. Like our water bugs these mole crickets must fly forth to mate. Why they were led to congregate in this particular room, it is difficult to say. It is possible that a student had caught a female, and thus the males were attracted, as we often see many males of our silk moths attracted by a single female. Male silk moths have even come down a stovepipe to reach the females. In reference to these insects I can only suggest as a remedy that potatoes be planted on upland.

SCABBY POTATOES.

During the past year, and to a less extent for two years, I have noticed many potatoes grown on low land that were so scabby that one could with difficulty place his finger on the potato without touching some one of these rough excrescences. In many cases the same potatoes were badly bored by wire worms, grubs of elater beetles. In some the mole cricket had burrowed. I think Prof. Arthur has shown that this scab is not due to fungous attack. Mr. Carman thinks he knows that in some cases myriapods, or the so-called thousand-legged worms, have caused this scab. I am just as sure that I know of cases where potatoes were quite scabby, and where the most careful examination could find no myriapods at all. It has occurred to me that abrasion of the surface of the tubers by any insect may cause this deformity. I have specially thought of this as I have seen potatoes this autumn that were terribly scabby, and which showed by numerous scars that insects were very plenty during their growth and development. Another summer I shall take great pains to learn what is the truth in the matter. If by planting on soil free from insects we can avoid the scab, it will be a matter of practical importance.

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A NEW APPLE TREE BORER.

I think that in none of our treatises on practical or economic entomology do we find any mention of *Saperda Cretata* as an enemy of the apple tree. For the last few years I have found it a more common insect here than the old well known *Saperda Candida*. I have known it to tunnel apple trees so seriously that they were materially injured. This beetle (Fig. 6) in form and size is a very close copy of the old *Saperda Candida*, though I think it will average a little larger. The figure shows the exact size of one in our collection. Except that the two white stripes, one along each wing cover, are broken in this species, it would be almost a perfect copy of the other. Indeed it may be only a variety. The remedy which I have so often advised for the borers and bark lice, the carbolic acid and soap mixture, applied to the trunk and main branches about the 10th of June, is also a good specific in this case.

Fig. 6.

WIRE WORMS.

These insects are serious enemies to corn, wheat, and other grains, as well as to potatoes in our State. I have known much damage to the corn crop from them this year. On a piece of low ground plowed in the autumn of 1887, and planted to corn in the spring of this year (1888), much injury was done, often every stalk for rods was destroyed. Upon examination, the field adjacent, a newly drained flat, intended for corn in 1889, was found well stocked with these grubs. At my suggestion the field was plowed in June and sowed to buckwheat. This field will be planted to corn next spring. I shall keep a close watch of the field, and shall report the result next year.

EXPERIMENTS IN THE APIARY.

Owing to the fact that bee keeping is receiving attention from no other State or station, and the fact that we here are well equipped for experiments in this important industry, it was thought wise to expend no slight energy in this direction. From my own long study of the subject, as well as from the advice of others which I consulted, it was thought best, not only to continue the experiments long kept up in wintering, and feeding, but also to experiment thoroughly in three other directions, viz: Crossing and breeding, with direct reference to the originating of a distinct and improved race; setting various bee plants to ascertain if it will prove profitable to plant soley for honey; and third to examine carefully the qualitys of various kinds of honey to determine if possible a test for honey and a means to correct the prevailing but erroneous opinion that honey is frequently and generally adulterated.

A building and grounds were secured and the old college plant was transferred to the Station. As the site of the new grounds was where an old brick kiln had once stood, and where the old brick were still in piles, where deep excavations had been made, and where the hard clay sub-soil was now uppermost, the first effort was to grade and fertilize the spot; which has been done. About one hundred and thirty bee trees and shrubs were secured and set out about the apiary grounds. The immediate site of the hives was graded and

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sodded. The area was planted to Chapman's honey plant, *Echinops sphærocephalus*; Alsike Clover, *Trifolium hybrida*, a foreign mint, a species of Melissa, and Japanese buckwheat. Considering the drouth, all the plants have done well. It is against the Chapman's honey plant that it does not bloom the first year after planting, though after that it lives and thrives indefinitely. The Melissa blooms early in August and continues to bloom till frost. I believe it is a good honey plant. I need not speak of Alsike Clover; its excellence as a honey plant, and also for hay and pasture have long been demonstrated. The Japanese buckwheat, though it may be no better for honey than common buckwheat, is wonderfully productive, and has a very large kernel. The bees did gather from this buckwheat afternoons as well as early in the day, though not so freely. It is said that bees never gather from common buckwheat after noon. They certainly do from this Japanese. It can also be said that this buckwheat is far more productive than our common buckwheat. We shall continue our experiment with these plants, and shall also add pleurisy root (*Asclepias tuberosa*), a very promising honey plant, and Rocky Mountain bee plant (*Cleome integrefolia*). This last I have grown for years in small plats, and it seems to me that it promises exceptionally well as a honey plant. If we can find plants which will insure a yield of honey despite the weather, we shall do the bee keeping industry a great good. If this is impossible, and we can demonstrate the fact, we shall still do a good thing, as we shall settle the matter and prevent a large amount of personal or private experiment, and thus save great expense.

BREEDING BEES.

There is no fact in bee culture better attested than that different races have peculiarities and excellences quite their own. Bees, unlike cattle, sheep, and horses, are kept for one single purpose, hence the objection which is rightly urged against crossing cattle, etc., does not hold in bee-keeping. Thus it has occurred to me that by judicious crossing and careful, painstaking selection, we can secure a new race of bees that shall combine all the good qualities of the several races with the undesirable characteristics eliminated. With this thought in view I commenced five years ago to cross the Carniolan and Syrian races, in hopes to combine the good qualities of these excellent breeds, and to get rid of the undesirable features which we must acknowledge exist in both.

Two or three years' previous experience had convinced me that the Syrian bees were exceedingly prolific, and that with the one exception of amiability they possessed all the excellent features of the Italian race, in some of which features they excelled even our justly prized Italians. If our Syrians were a little more amiable, and if their comb honey was as white as that of our German bees, we should have in them a bee superior to any other.

The Carniolan bees, while they are energetic, are amiable beyond any other race. They also give us very white comb honey, and barring the fact that they are a little too ready to swarm, they would at once march to the front as the most desirable race of bees known, a position which some of the European bee masters give them even now.

I have been engaged in this work too brief a time to speak excathedra, and I have been too much occupied to give the care to the breeding which the best success demands; but even now I think the success encouraging. Our

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bees are very gentle, reminding us of the pure Carniolan,' and exceedingly prolific, nearly if not quite equalling the Syrians. Nor do they exhibit any undue tendency to swarm. Thus I already feel encouraged, and with the better opportunity now offered I am very hopeful of results that will more tha nwarrant the time, expense and labor expended. A beekeeper of considerable experience who has worked with our bees this year, praises them very highly as the most quiet and prolific bees that he has ever seen, though he has worked for years with both the Italian and German races.

TESTS FOR HONEY.

The impression has got abroad that much of our honey is adulterated. This, whatever may have been the truth years ago, when the price of honey was very high, is not true to-day. Bee keepers never practiced adulteration. Some years ago dealers did. Now, adulteration, owing to the low price of honey, would not pay. From careful investigation, I am sure apiarists have never engaged in such dishonest practice. The fact that honey has been very scarce the past year, after the poor honey season of 1887, shows conclusively that adulteration is not now practiced even by dealers, and as just stated, it will not pay. Yet some of our excellent chemists have reported that adulteration is still practiced. This would be convincing in spite of the facts just stated, except that some specimens pronounced impure were certainly honey just as it was stored by the bees. This emphasizes the importance of a thorough investigation of the matter of honey tests. Owing to the varying composition of nectar, and the more or less complete digestion of the nectar, it would appear that honey must vary greatly in its composition. This fact, with the known determinations that were incorrect, convince me that it is very important that very careful analyses be made that we may certainly know the truth, and thus be able to correct the erroneous impressions, which are greatly detrimental to bee keepers. With this end in view, I have commenced the collection of honey from various sources and various localities. I have already many samples of known origin. It is the plan to have these tested, and see if it is possible to pronounce with certainty as to the purity of honey. This, then, is the third problem which it is intended to solve.

The present autumn we intend to put a windbreak west of the apiary and also to set honey producing shade trees about the grounds. Next year we shall increase our bees till we have seventy-five or one hundred colonies; thus we can investigate any new subject which may arise in connection with apiculture.

A. J. COOK.

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REPORT OF THE BOTANIST.

To Hon. Edwin Willits, Director of the Experiment Station:

DEAR SIR,—I herewith submit my first annual report for the year closing June 30, 1888:

THE JACK-PINE PLAINS.

In my part of the experimenting on the northern sands of Michigan, I started with the attempt to answer two questions:

1. To find one or more grasses or other forage plants that shall be better adapted to the soil and climate than any heretofore in general use in such places.

2. To test many kinds of forest trees to learn which are best fitted to plant for timber on the sandy plains.

An effort to answer either one of these two leading questions very naturally suggests several other questions, such as the proper modes of seeding, planting and cultivation, whether one kind only of either grass or tree should be allowed to occupy the ground at the same time, whether several grasses or other forage plants shall be sown together, and whether several kinds of trees shall be set together.

Again, for grass or tree, will it be most profitable in the end to thoroughly prepare the ground before planting, to make a slight and cheap preparation, or simply sow and plant in open places, without any removal of rubbish, without cutting any tree or shrub, or without plowing or harrowing the land.

EXPERIMENTING AT GRAYLING.

The grass plats are each one rod square, and occupy about two acres of the "old" land which was rented. Most of the species of forage plants which I desired to try have not been tested to any extent in this country. Many of them have not found their way into cultivation, at least only sparingly in isolated places. Seeds of these are not in the markets of the world, and can only be secured by going after them or through the efforts of botanists in remote countries.

We were not sure of money for carrying on any experiments till early spring of this year, when it was from six to ten months too late to procure seeds for use in the year 1888. All that could be done was to get ready and sow such as could be purchased, together with a small quantity of other seeds, which were fortunately on hand at the College. The first sowing was on May 15, and other sorts requiring more heat were sown late in May.

The following is the list of grasses and forage plants with a few others:

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Agropyrum dasystachyum Vasey.
A. divergens Nees.
A. glaucum R. & S.
A. tenerum Vasey.
Agrostis alba L.
(Red Top.)
Alopecurus pratensis L.
(Meadow Foxtail.)
Andropogon provincialis Lam.
(Finger grass.)
A. scoparius, Michx.
Anthoxanthum odoratum L.
(Sweet Vernal Grass.)
Arrhenatherum avenaceum Beauv.
(Tall Oat-grass.)
Bouteloua olygostachya Torr.
Bromus unioloides Willd.
(Schrader's Bromus.)
Ammophila longifolia Benth.
Coix lachryma L.
(Job's Tears.)
Cynodon Dactylon Pers.
(Bermuda Grass.)
Cynosurus cristatus L.
(Crested Dog's-tail.)
Danthonia spicata Nutt.
(Old Fog.)
Deschampsia cæspitosa Beauv.
Eatonia obtusata Gray.
Eleusine coracana.
Festuca arundinacea.
(Mammoth Fescue.)
F. duriuscula.
(Hard Fescue.)
F. elatior L.
(Tall Fescue.)
F. ovina L.
(Sheep's Fescue.)
Holcus lanatus L.
(Velvet Grass.)
Kœleria cristata Pers.
Lolium Italicum L.
(Italian Rye Grass.)
L. perenne L.
(Perennial Rye Grass.)
Oryzopsis Canadensis Torr.
Panicum dichotomum L.
Pennicillaria spicata.
(Pearl Millet.)
Phalaris Canariensis L.
(Canary Grass.)
Phleum pratense L.
(Timothy.)
Poa nemoralis L.
(Wood Meadow Grass.)
P. Nevadensis Vasey.
P. pratensis L.
(June Grass.)
P. serotina Ehrh.
(Fowl Meadow Grass.)
Reana luxurians L.
(Teosinte.)
Secale cereale L.
(Spring Rye.)
Setaria Italica Kunth.
(Hungarian Grass)
Setaria.
(German Millet.)
Sorghum halapense L.
(Johnson Grass.)
Sorghum vulgare L.
(Amber Cane.)
Brassica Rapa L.
(Rape.)
Cannabis sativa L.
(Hemp)
Carex Pennsylvanica Lam.
Fagopyrum esculentum Mœnch.
(Silver-hulled Buckwheat.)
F. esculentum Mœnch.
(Common Buckwheat.)
Hedysarum coronarum.
Helianthus annuns L.
(Western Sunflower.)
Lathyrus.
(Blue Russian Pea.)
Lathryus.
(Blue Field Pea.)
Lathyrus.
(Blue White Pea.)
Lathyrus.
(Golden Vine Pea.)
Lathyrus sativus.
Linum usitatissimum L.
(Flax.)
Lotus corniculatus.
Lupinus.
(Italian Lupine.)
Lupinus.
(Blue Lupine.)
Melilotus alba Lam.
(Sweet Clover.)

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Ornithopus sativus.
(New Zealand Spinach.)
Spergula arvensis L.
(Spurry.)
Spergula maxima.
(Giant Spurry.)
Trifolium hybridum, L.
(Alsike Clover.)
T. medium L.
(Mammoth Clover.)
T. pratense L.
(Red Clover.)
Tr. repens L.
(White Clover.)
Vaccinium.
(Dwarf Blueberry.)
Vicia sativa L.
(Vetches.)
V. villosa.
(Hairy Vitch.)
Vitis.
(Niagara Grape.)

The finer seeds were generally sown broadcast and raked in; the larger were sown or planted in rows or in "hills" and have been hoed.

The last examination of the plats was made on June 16, too early to make it worth while to notice in this place the degree of success of each plat. By autumn of 1888, and the spring following, I shall have ready seeds of many other species from various sources.

The trees planted were about 6,600 in number and belonged to seventy-six species and varieties. They ranged from four inches to two feet in height, most of them being about one foot high. A few poplars and willows were in the form of cuttings. Thirty-five species from Iowa Agricultural College were represented by a few trees each, and were raised from stock which had been imported from central Russia. They were planted in close rows on the "old" land which was rented.

The names of the Russian trees are as follows:

Amygdalus Sibirica.
Betula alba verrucosa.
Capitatus cytisus.
Caragana alabra.
" *fruticosa.*
" *lutea.*
" *mollis.*
" *pygmea.*
Cornus Sibirica.
Eleagnus angustifolia.
Euonymus nana.
Hippophea chamnoides.
Hypericum hercinus.
Populus alba musa.
" *argentea.*
" *certinensis.*
" *fastigiata.*
" *petrosky.*
Populus pyrimidalis.
" *Sibirica.*
" *Wobsti.*
Potentilla fruticosa.
Ribes alpinum.
Salix acutifolia.
" *argentea.*
" *aurea.*
" *Britensis.*
" *fragilis.*
" *vitellina.*
Spiræa Douglasii.
" *callosa.*
" *hypericifolia.*
" *nobleana.*
" *Thunbergia.*
Windene, Russian dewberry.

The other trees were bought of W. W. Johnson, of Snowflake, Antrim county, and shipped direct to Grayling. One acre of newly broken and well prepared land was planted to representatives of each of the kinds obtained of Mr. Johnson. These were planted in rows four feet apart each way and were well mixed, so that evergreens and other shade loving trees alternated with those which would not thrive in much shade. These trees last noticed, I intend to keep cultivating for some years to come. Near them was a piece of

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unbroken new ground containing a few scattering Jack-pines (*Pinus Banksiana*) and some scrub oaks, perhaps ten feet high and under. There was also a considerable quantity of three kinds of low blueberries, one bear berry, trailing arbutus, wintergreen, eagle fern, sweet fern, some dwarf service berry, choke cherry and a few grasses and other perennials. Two acres of this land was passed over once with a spring-toothed harrow, which seemed to tear up the soil considerably, though most of the wild shrubs and other perennials were still left in the ground ready to grow. On this land were planted an assortment of the trees obtained of Mr. Johnson. Another lot of the same kinds was planted on a piece where there had been no cultivation.

The list of trees above referred to appears below:

Acer dasycarpum Ehrhart.
(Silver Maple.)
Acer platanoides.
(Norway Maple.)
Acer Pseudo-platanus.
(Sycamore Maple.)
Acer rubrum L.
(Red Maple.)
Acer saccharinum Wang.
(Sugar Maple.)
Betula lutea Michx.
(Yellow Birch.)
Betula papyracea Ait.
(Paper Birch.)
Catalpa speciosa Warder.
(Hardy Catalpa.)
Celtis occidentalis L.
(Hackberry.)
Fagus ferruginea Ait.
(Beech.)
Fraxinus Americana L.
(White Ash.)
Fraxinus Sambucifolia Lam.
(Black Ash.)
Fraxinus viridis Michx.
(Green Ash.)
Gleditschia triacanthos L.
(Honey Locust.)
Gymnocladus Canadensis Lam.
(Ky. Coffee-tree.)
Juniperus Virginiana L.
(Red Cedar.)
Larix Europæa L.
(European Larch.)
Morus.
(Russian Mulberry.)
Negundo aceroides Mœnch.
(Box Elder.)
Picea alba Link.
(White Spruce.)
Picea excelsa.
(Norway Spruce.)
Pinus resinosa Ait.
(Red Pine.)
Pinus Strobus L.
(White Pine.)
Pinus sylvestris L.
(Scotch Pine.)
Populus argentea L.
(Silver Poplar.)
Populus argentea Vas.
(Large Silver Poplar.)
Populus balsamifera L.
(Balsam Poplar.)
Populus balsamifera,
Vas. *Candicans* Gray.
(Balm of Gilead.)
Prunus serotina Ehrh.
(Black Cherry.)
Robinia Pseudocacia L.
(Common Locust.)
Salix alba L.
(White Willow.)
Salix alba var. *vitellina.*
(Yellow Willow.)
Salix purpurea.
(Purple Willow.)
Salix.
(Wisconsin Weeping Willow.)
Thuya occidentalis L.
(Arbor Vitæ.)
Tilia Americana L.
(Basswood.)
Ulmus Americana L.
(American Elm.)
Ulmus campestris Sm.
Ulmus montana Sm.
Ulmus racemosa Thomas.
(Rock Elm.)
Ulmus fulva Michx.
(Red Elm.)

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Michigan is yet a well timbered State, but the time is fast approaching and will be seen by many now living when our people will be making all sorts of inquiries as to what to plant and how to manage a tract of young trees for producing timber. It is a question whether considerable portions of our cheapest pine plains and "stump lands" had not better be replanted to forest trees.

We do not know for certain what is the best course to pursue, nor can any one at present tell us. We should continue experimenting till we know more nearly than any one does at present. Much has been done in Europe, but the people are so different, the laws are so unlike our own, and the country so much older and thickly settled, that we are left, to a great extent, to work out the growing of new forests to our own resources.

To enable us to experiment the better, it is of the very first importance that some of us make long continued studies of the existing forests in our own State. We need to know more of the various combinations of trees, shrubs and other undergrowth of virgin forests in various parts of the State, also to study the growth which rapidly springs up where a forest has been removed.

At Oscoda there are healthy trees of the common locust, in Crawford and in Grand Traverse counties there are some. These trees were seen growing in light sand and on better soil, and in all cases they were sound, without damage from insects.

I need hardly say, that one of the leading objects of the recent visits in the north, is above stated, viz., to study the existing forests with a view to making intelligent experiments in growing trees.

OTHER STATIONS.

It was urged by the Director and approved by the State Board of Agriculture, that we yield to the urgent demands of a large number of citizens in the northern part of the State and select small pieces of land of about ten acres each, located in four other counties. This land should also be pine plains and at each station essentially the same experiments should be tried. There may be a little difference in soil and in other respects, but results can be more quickly obtained and with more satisfaction than they could by making all the experiments in one place.

The writer, with the advice of the Director, was to select, rent the land, plan and conduct the experiments.

OSCODA.

Through the influence of Hon. D. P. Markey, a member of the house of the last legislature, and on account of the fact that the College has a large amount of land in Iosco county, it was decided to locate a sub-station at Oscoda, near the mouth of the Au Sable river.

No College land in the northern counties was available for experiments, as it was too far removed from railway stations.

Mr. James Barlow owns a farm on the south of the river and half a mile northwest of the railway station. Most of his farm consists of river bottoms or was a swamp densely covered with cedar, tamarack, black ash, and other timber. This rich land had been cleared and much of it drained, and on it Mr. Barlow is easily and uniformly raising large field and garden crops.

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Back from the river on a terrace is a strip of true Jack-pine plains. I called on the owner of this farm and without any introduction made my errand known. He said, "There is no use of your trying any experiments on this Jack-pine land. I have experimented here on such soil to my satisfaction and it is not good for anything, unless it be to use for barn-yards. Others about here have wasted in experiments a good deal of time and money. I tell you the land is worth nothing for farming, but I am willing you should try it, and if you want, I will give you a deed of ten acres." The gift was accepted; the deed has been given and recorded; the land well fenced and half of it cleared, plowed and harrowed. After sowing and harrowing, the ground was rolled. Below is given a plan of the plats with the seeds sown on each. The size of the plats is about three by ten rods each.

THE EXPERIMENTAL PLATS.

Where a plat is marked as containing nine sorts there are the following: Orchard grass, Perennial rye grass, June grass, Meadow foxtail, Red clover, Mammoth clover, Alsike clover, Timothy, Meadow fescue.

N. ——— S.

	No plowing, no harrowing; nine sorts, mixed. Sown May 15.
	This plat only harrowed, not plowed; nine mixed sorts. Sown May 15.
Blank.	Field Peas. Sown May 15.
Spring rye. Sown May 15.	Nine sorts, mixed. Sown May 15.
Perennial Rye Grass, Mammoth Clover, mixed, } Sown May 15.	Perennial Rye Grass. Sown May 15.
Perennial Rye Grass, Orchard Grass, } Sown May 15.	Italian Rye Grass. Sown May 15.
Mammoth Clover, Orchard Grass, mixed, } Sown May 15.	Orchard Grass. Sown May 15.
Mammoth Clover. Sown May 15.	June Grass. Sown May 15.
Alsike Clover. Sown May 15.	Meadow Foxtail. Sown May 15.
Alfalfa, or Lucerne, with a little Mammoth Clover on one side. Sown May 15.	Hungarian Grass. Sown May 15.
Timothy. Sown May 15.	Millet. Sown May 15.
Meadow Fescue. Sown May 15.	Sweet Clover. Sown May 15.
Spurry. Sown May 15.	Red Clover. Sown May 15.

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On July 15, the plats were examined and a few notes made. The weather had been very dry. Seeds on all the plats had come up well. None were seen where the young plants had died from drouth or great heat. The spurry was thin, some of it a foot high, much that was less, seeding freely. Timothy was seldom over an inch high. Meadow foxtail very small and thin. Orchard grass better, and two or three inches high; other grasses much the same as Orchard grass. Rye very slim, one to three feet high, with short spikes. Peas pale, slim, one foot high, bearing very few pods, in many cases no pods. No fertilizers were applied to the land.

Some of the land will be planted to small forest trees next spring.

HARRISON.

After a little correspondence with Hon. F. A. Wilson, of Harrison, a member of the last legislature, the writer visited that village which is the county seat of Clare county. Mr. Wilson, with the president of the village, the editor of the town paper, and a farmer accompanied the writer on the morning of the 26th of April, in search of a suitable spot for experimenting. Five acres of land three miles north of town were rented of B. B. Pixley. This was not new land, but had been successively cropped for six years without manure or seeding to grass. The first crop was most likely "bagas," and some good muskmelons and watermelons; the second crop oats; the third beans; the fourth corn or beans; the fifth buckwheat or millet, the latter very light; the sixth short, light oats.

As a piece of land treated in this manner is much like that of many abandoned farms in the north, it seemed well to select it for experimenting.

The land was nicely plowed, and sown on May 7, in plats, with the same kind of seeds as those sown at Oscoda. The land was rolled after seeding.

The alfalfa, millet and Hungarian grass were sown near the end of May. On August 1, the plats were examined. The season had been very dry. Without going into details, none of the plats were as promising as similar plats in Oscoda, Baldwin or Walton, where the land was newly broken this spring. The whole piece was weedy with lamb's quarter, Setaria (pigeon grass), sorrel, wild morning glory.

The people of Harrison and vicinity were not satisfied with a temporary station on rented land. W. H. and F A. Wilson offered to give any amount of land not exceeding forty acres on which experiments should be made.

I selected ten acres of new land, half a mile north of the village, near the fair ground and the railroad. This appears to be rather better than a good deal of the Jack-pine land. Some scattering trees of Norway pine of good size had been formerly cut. The deed has been given, recorded, and the land already well fenced. Some of this land will be prepared for crops and plats sown next spring. Some forest trees will also be planted there.

BALDWIN.

This village is located on the F. & P. M. Railroad, and is the county seat of Lake county. About eight acres have been rented of T. V. Childs, who is living on his farm and managing it in a thorough manner. It is typical Jack-pine plains. The part rented had not been plowed till this spring. The piece joins the Chicago & West Michigan Railway, and is some forty rods

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south of the village school-house. Most of the plats were sown on May 9, the land harrowed and rolled. As at Harrison and Oscoda, a few sorts were sown later when the soil had become quite warm. The plan of the plats is very nearly the same as that given for Oscoda.

Notes were taken on July 30. The weather had been very dry, though we had a nice rain last night.

The crops tested all average a little better than those at Oscoda, though this may partially be owing to the difference in time when the notes were made.

There is considerable *Euphorbia corollata* and a few other scattering weeds and native plants.

WALTON.

This village is on the Grand Rapids & Indiana Railroad, and is in the southeast part of Grand Traverse county. One-half mile northwest of town, next to the railway, extending to Traverse City, is a piece of ten acres, well fenced, belonging to Abram F. Philips. Five acres in the southeast corner of this lot was rented for experiments. The land was new, but all ready for the plow. It had contained a little white and Norway pine and a few small white oaks, but it is a fair grade of Jack-pine plains. The land was platted, prepared, and the seeds were sown and the land harrowed on May 11, excepting that the alfalfa, millet and Hungarian grass were sown late in May. The land was rolled after harrowing. The seeds were placed on plats essentially the same as at Oscoda and Baldwin and Harrison.

EXPERIMENTS AT THE COLLEGE.

An arboretum of nearly two acres was begun in 1875, and contains about 150 species of trees and shrubs. Several former reports, including one bulletin, have given information in regard to this interesting piece of land and what is growing thereon.

There is in preparation a piece of land for experimenting with grasses and clovers and other forage plants.

The triangular field of five and one-half acres situated at the forks of the North Lansing and Middletown roads has been secured for experiments in grasses and forage plants.

It was an old pasture and has been seeded twenty years or more. It was broken in the early part of June, to remain fallow during the summer. The soil ranges from sand to heavy clay, both yellow and blue. Intermediate are gravelly soil and clay-loam. The sand and yellow clay are high, the clay-loam at the foot of a slope, and the blue clay with loamy surface is low and wet. All except the latter portion is to be thoroughly under-drained. Patches of the old sod have been left in four places to compare with new seeding, and possibly to note the effect of drainage.

It is the intention to make an artificial pond and marsh in the low ground for marsh-grasses. The banks will be flat, furnishing all grades between a moist and a wet soil. The field is to be surrounded with a plain board fence.

The rest of this summer will be required to completely fit this field, and to collect the seeds of all grasses native to this vicinity for planting here and at the north, and for exchange with other stations.

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Efforts have been made to secure prominent grasses from other sections, and from some foreign countries.

OPPORTUNITIES FOR STUDYING NORTHERN MICHIGAN.

In former years, the writer has made numerous visits to the northern part of the State, twice as chairman of the orchard committee of the State Horticultural society, and several times to attend farmers' institutes.

Winter before last a farmers' institute was held in Crawford county, and last winter another in Alcona county. At both of these, subjects of the greatest importance to the people of that new county were freely discussed. While attending the latter institute held in Harrisville, the writer expressed a wish to make extended tours through these and other counties during the summer season.

President E. Willits promptly saw the need of a careful examination of that part of the State, and with his accustomed zeal, promised to do all he could to favor such studies in the summer of 1888.

At the expense of the State experiment station and forest commission and in the interests of scientific agriculture in its broadest sense, the writer has this year made four visits to the northern part of the southern peninsula of Michigan. The journeys have extended from Lake Huron to Lake Michigan and as far north as Elmira and Gaylord.

To aid in getting a comprehensive view of this portion of our land, a party for this purpose was selected by the writer and consisted of Prof. L. H. Bailey, Jr., C. F. Wheeler, of Hubbardston, L. A. Dewey and D. A. Pelton, the last two members af the senior class of the Agricultural College. Hon. C. W. Garfield, one of the directors of the forestry commission, was to have joined us, but ill health prevented. The editors of the *Free Press* and the *Tribune*, of Detroit, saw and were ready to improve an opportunity to gather information for their readers. Mr. Fisher, of the former paper, and Mr. H. Parish, of the latter, were most gladly welcomed as members of our party. W. W. Metcalf, of Grayling, was our teamster, and in many places also served as a guide through parts of the newly settled country, where it is often difficult to decide which is the highway and which is a road to some farmhouse or lumber camp.

The party started from Harrisville on June 11. We rode or walked, observed, asked questions, took notes, collected specimens, and Professor Bailey took photographs of trees and other objects. This occupied two weeks, when we returned home from Frankfort, in Benzie county. About the middle of July, Mr. Wheeler and myself spent two days examining the country in the vicinity of the mouth of the Au Sable river.

THE FLORA OF NORTHERN MICHIGAN.

One leading object of the expedition was to study the plants of the country. Several of us had made out in advance lists of interesting plants which we especially desired and expected to find.

A number of persons have expressed a strong desire that we should publish a list of the plants found in Northern Michigan.

I am sure that the list is very incomplete, owing to the limited amount of time spent in the field. A large portion of the territory was passed over in

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June, when some of the spring flowers were going to seed, and a still larger number of plants were too young to be identified with any degree of certainty.

For these reasons I think it unwise to print a list in this report, but will give short notes on a few plants found during the summer :

Menispermum Canadense L. Moonseed.

A form found in Oscoda county in which the leaves were deeply lobed.

Viola blanda var. *renifolia* Gray.

A very attractive plant, collected in several swamps in the north.

Claytonia Caroliniana Michx.

This has been found by E. J. Parker, of Benzie county, I believe for the first time in the State.

Ceanothus ovalis Bigelow.

Found in Crawford and Oscoda counties in abundance.

Potentilla tridentata Ait.

Abundant in Crawford and Oscoda counties.

At Harrisville, Alcona county, within a few rods of each other are growing luxuriant plants of

Ribes Cynosbati L., *R. oxycanthoides* L., *R. lacustre* Poir.

R. prostratum L'Her., *R. floridum* L., *R. rubrum* L.

Œnothera biennis L.

In Oscoda county a branching form of this is nearly spherical and becomes a good "tumble weed."

Petasites (*Nardosmia*) *palmata* Coltsfoot.

Found frequently in brooks and marshes from Harrisville clear across the State.

Cnicus pumilus Torr. Low or Pasture Thistle.

Found on plains land clear across the State, at least, as far north as Crawford county. Sometimes bearing ten or a dozen heads. A very interesting and striking plant.

Vaccinium vacillans Solander. Canada Blueberry.

Very common on sandy plains with *V. Canadense* and *V. Pennsylvanicum*, at least north to Crawford county.

Dracocephalum parviflorum Nutt. Dragon-Head.

This was found in Alcona county towards the west side.

Marrubium vulgare L. Horehound.

In Grand Traverse and Benzie counties, where the snow comes early and remains all winter so as to keep the ground from freezing, this plant often becomes a prominent weed.

Asclepias obtusifolia Michx.

This occurs near Baldwin in Lake county, and, so far as I know, has not previously been found in the State.

Picea alba Link. White Spruce.

Along the Au Sable river for a good part of its length.

Sparganium simplex, var. *Nuttallii* Gray.

This occurs at Oscoda at the mouth of the Au Sable river.

Sparganium minimum Bauhin.

This was found in Benzie county.

Sagittaria heterophylla Ph.

Found in Iosco county.

Sagittaria graminea Michx.

Found near Agricultural College, Ingham county, by Prof. L. H. Bailey.

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Habenaria obtusata Richardson.
Iosco and Benzie counties.
Listera cordata R. Br.
Found in Crawford county by Mr. Hicks and others.
Listera convallarioides Hook.
This occurs in Benzie county.
Calypso borealis Salisb.
Found in Crawford county by Hicks and in Benzie county by Parker.
Liparis Læselii Richard.
Found recently in Iosco county.
Zygadenus glaucus Nutt.
Found in Oscoda and in Benzie counties.
Sedges were abundant and freely collected.
Oryzopsis Canadensis Torr.
Common on plains from Alcona to Benzie counties.
Stipa avenacea L.
Found at Baldwin in Lake county.
Glyceria pallida Trin.
This occurs at Lansing.
Poa cæsia Smith.
This occurs in Benzie county.
Eragrostis pectinacea var. *spectabilis* Gray.
Howard City in Montcalm county.
Agropyrum dasystachyum Gray.
Occurs in sand on the lake at Au Sable, Oscoda county, and at Frankfort in Benzie county.
Avena Smithii T. C. Porter.
This has been found again, this time in Garfield and Crystal Lake in Benzie county.
Dr. Geo. Vasey, botanist of the Agricultural department at Washington, expresses the opinion that this is not an *Avena* but a *Melica*. The awn is straight, there are no hairs at the base of the florets, and the plants have a bulb, as is the case with many species of Melica. I have not yet examined the specimens critically, but believe Dr. Vasey is correct in his opinion. The structure of the leaf is that of a *Melica* and not an *Avena*. It occurs with *Avena striata* and grows in much the same manner. It was but little taller than *A. striata*.
Panicum pauciflorum Ell.
It occurs in Clare, Bay and Lake counties, as well as in some other places.
Equisetum scirpoides Michx.
This has been found from Alcona to Benzie counties.
Botrychium Lunaria Swartz.
This occurs at Harrisville, Alcona county.
Botrychium simplex Hitchcock.
This was found at Oscoda in Iosco county.
Selaginella rupestris Spring.
Found on sandy plains in many parts of the southern peninsula.
Acer nigrum Michx.
This occurs in considerable quantity in the southern portion of the State, including Ingham county. In our recent trip from Alcona to Benzie counties not a specimen was seen by any of our party, though immense tracts of *A. saccharinum* was seen.

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THE FLORA OF THE JACK-PINE PLAINS OF MICHIGAN.

The portion of this report under the above heading was presented as a paper at the summer meeting of the Society for the Promotion of Agricultural Science held in Cleveland, Ohio.

The southern peninsula of Michigan in no place rises into what may be termed mountains, as the highest plateaus are only about 1,200 feet above the surface of Lakes Michigan and Huron. The drift is very thick and rocks are seldom exposed at the surface. The nature of the soil varies according to the rocks from which it is formed, whether it is made from shale, granite, limestone or sandstone, either one nearly pure or whether from a mixture of two or more. The Waverly group is represented over a large part of the surface and it contains much sand-rock.

As almost every one knows, the southern peninsula of Michigan has a fine climate tempered by the great lakes which surround it on three sides. A good deal of the northern half of the peninsula which we are considering is sandy or in some places a sandy loam. In such a climate as ours, the soil to a great degree determines what naturally grows upon it, or to state the reverse, an expert soon learns to judge of the nature of the soil by what he sees growing upon it.

This sandy soil in some places rests on similar sand of great depth. It dries out quickly after a rain, and is then especially liable to be burned over, the burning often destroying every living plant above the surface of the soil. The fire removes much of the vegetable matter, so that the new growth is often thin and is more liable than ever to become dry and burn over again and again. Such land is often gently rolling and with the scattered low trees presents an attractive appearance. It looks as though it would make a nice farm. The ease with which it can be cleared has induced many a man to purchase and begin to establish a home.

Owing to the poor soil and improper management, after a few years many have abandoned their homesteads in discouragement.

We saw several of these deserted homesteads where much effort had been spent in placing things in neat order. There was a comfortable house, a log barn, hog pen, board fence, with a nice gate in front of the house. There were some fruit trees, shade trees, ornamental shrubbery and the remains of the flower garden. All was left to return to a state of nature. It was sad to view these lonely homesteads.

Many now believe in the words of the late State geologist, C. Rominger, "that the productiveness is so soon exhausted and its moisture so soon lost, that it can never be used for agriculture on a large scale with any prospect of success."

Whether the latter statement be true or not, it is not now my purpose to attempt to decide.

At the risk of being tedious, I will venture to call your attention to a list of seventy plants, all of which are almost certain to be found in considerable quantity on any extended area of Jack-pine plains:

Twenty-six of those which appear to be most abundant everywhere on the plains are designated in this list by a *.

Helianthemum Canadense Michx. Frost Weed.
Viola pedata L. Violet.
Viola canina var. *sylvestris* Regel. Violet.

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Polygala polygama Walt. Pink Polygala.
Ceanothus Americanus L. New Jersey Tea.
**Prunus pumila* L. Sand Cherry.
**Prunus Pennsylvanica* L. Wild Red or Pin Cherry.
**Prunus Virginiana* L. Choke Cherry.
Rubus Canadensis L. Dewberry.
Rubus hispidus L. Dewberry.
Fragaria Virginiana var. *Illinoiensis* Gray. Strawberry.
Potentilla Canadensis L. Five-finger, Cinque-foil.
Potentilla tridentata Ait. Three-toothed Cinque-foil.
**Amelanchier Canadensis* var. *oblongifolia* Torr. and Gray. Dwarf June Berry.
Œnethera biennis L. Evening Primrose.
Aralia hispida Michx. Bristly Sarsaparilla.
Diervilla trifida Mœnch. Bush Honeysuckle.
Houstonia purpurea var. *longifolia* Gray. Houstonia.
Liatris cylindrica Michx. Blazing Star.
* *Solidago nemoralis* Ait. Golden Rod.
Solidago arguta Golden Rod.
* *Aster levis* L. Aster.
* *Erigeron Canadensis* L. Horse Weed.
Erigeron strigosus Muhl. Daisy Fleabane.
Antennaria plantaginifolia Hook. Plantain-leaved Everlasting.
Gnaphalium decurrens Ives. Everlasting.
Rudbeckia hirta L. Cone-flower.
Helianthus divaricatus L. Wild Sunflower.
Helianthus occidentalis Riddell.
Cnicus pumilus Torr. Low Thistle.
Krigia amplexicauis Nutt. Dwarf Dandelion.
Hieracium venosum L. Rattlesnake Weed.
Campanula rotundifolia L. Bluebell.
Gaylussacia resinosa Torr. and Gray. Black Huckleberry.
* *Vaccinium Pennsylvanicum* Lam. Dwarf Blueberry.
* *Vaccinium Canadense* Kalm. Low Blueberry.
* *Vaccinium vacillans* Solander. Low Blueberry.
* *Arctostaphylos Uva-ursi* Spreng. Bear-berry.
* *Epigæa repens* L. Trailing Arbutus.
* *Gaultheria procumbens* L. Wintergreen.
Apocynum androsæmifolium L. Dogbane.
Lythospermum hirtum Lehm. Hairy Puccoon.
Convolvulus spithamæus L. Low Bindweed.
Melampyrum Americanum Michx. Cow-Wheat.
Monarda fistulosa L. Wild Bergamot.
* *Rumex Acetosella* L. Sheep Sorrel.
Comandra umbellata Nutt. Bastard Toadflax.
* *Comptonia asplenifolia* Ait. Sweet Fern.
Quercus alba L. White Oak.
* *Quercus coccinea* Wang. Scarlet Oak.
* *Quercus tinctoria* Bartram. Black Oak.
* *Salix humulis* Marshall. Low Willow.
* *Populus tremuloides* Michx. Aspen.

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Populus grandidentata Michx. Large-toothed Aspen.
* *Pinus Banksiana* Lambert. Scrub or Jack-Pine.
Pinus resinosa Ait. Red or Norway Pine.
Pinus Strobus L. White Pine.
Maianthemum bifolium DC.
* *Carex Pennsylvanica* Lam. Pennsylvanian Sedge.
Panicum depauperatum L. Panic-grass.
Panicum dichotomum L. Panic-grass.
* *Andropogon provincialis* Lam. Finger or Beard-grass.
* *Andropogon scoparius* Michx. Beard-grass.
* *Oryzopsis Canadensis* Torr. Mountain Rice.
Agrostis scabra Willd. Hair-grass.
* *Danthonia spicata* Beauv. Wild Oat-grass.
Kœleria cristata Pers. Kœleria.
Festuca ovina L. Sheep's Fescue.
* *Pteris aquilina* L. Eagle Fern.
Lycopodium complanatum L. Club-moss.

The above list consists of representatives of twenty-seven families, of fifty-four genera, and of seventy-two species.

Were we to include all the plants ever found on such plains and all found in the neighborhood of the plains we might find, perhaps, nine hundred species, or twelve times as many as are above enumerated.

The above list is as nearly typical as I am able at present to make it, and is the result of repeated studies over a large extent of territory.

The families of plants best represented on the plains are the *Rosaceæ* by nine species, *Compositæ* by fifteen species, *Vacciniaceæ* by seven species, and *Gramineæ* by nine species.

The following large and prominent families of the State are not represented in the list above given: *Ranunculaceæ, Cruciferæ, Caryophyllaceæ, Saxifragaceæ. Umbelliferæ, Orchidaceæ.*

Most remarkable of all is the absence of any *Leguminosæ*, though the family contains 6,500 species and is the second in size only to the *Compositæ*.

In the report of the Forestry Commission, where the succession of forests is presented, I have shown how well *Pinus Banksiana* is adapted to succeed itself when all the trees are killed by severe fire.

The number of biennials given in this list is remarkably small, and there are no annuals in it. In this list is a thistle and two species of erigeron which seed freely and the wind aids in sowing the seeds. The evening primrose seeds abundantly and often on these plains grows in a globular form, a foot to two and one-half feet in diameter. When ripe it loosens its hold on the soil and becomes a "tumble weed," rolling for considerable distances before the wind and scattering its seeds on the way.

In like manner, I might lengthen this paper by showing the special adaptation of each of these plants in the above list to survive the severe tests applied to it on these sandy plains.

Of this list of seventy species, sixty-eight are perennials and four are biennials.

The perennials are mostly persistent plants well adapted by long deep roots and rootstocks to live in poor soil which is subject to severe drouths. Most of them are admirably adapted to surviving, after a severe fire has burned over the ground and killed the tops of the plants.

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COMPARISON OF THE FLORA OF EASTERN AND WESTERN MICHIGAN IN THE LATITUDE OF 44° 40′.

On the east side, next to Lake Huron, this is at Harrisville and vicinity in Alcona county and westward. On the west side, next to Lake Michigan, the country studied was at Frankfort and vicinity in Benzie county and east of there.

Besides Harrisville on the east shore, some time has been given to studying the flora at the mouth of the Au Sable river, about fifteen miles south of Harrisville.

The prevailing winds on both sides of the lake are from the west and southwest. In each case the country slopes gently towards the lake to which it is adjacent. It has long been known that the climate of the west shore where the wind sweeps across Lake Michigan was milder in winter, and throughout the year less variable than it is on the east side of the State. This is not only evident by a test of thermometers on the two shores, but tender fruits and some other plants thrive better on the west shore than on the east. So far as observed, the plants of the State which are only found in the vicinity of the great lakes are most abundant in individuals on the west shore.

The prevalent west winds produce the shifting sand dunes which are sometimes 200 feet high and are favorable for the shore-plants. The lake is gradually washing down and carrying away the land on west the shore. On the east side of the State the shore is generally lower and there are no sand dunes worthy of the name. At the mouth of the Au Sable river above and below, along the lake for many miles, there are low ridges of sand five to ten feet or more above the lake. The sand is washed ashore by the lake. These ridges are two to eight rods wide and separated near the lake by a lagoon about as wide as the ridge. The ridges in some places look as though some company had graded a track for a new railroad. These ridges parallel with the lake shore south of Oscoda up to thirty in number can easily be counted. The last ridge now forming is already much wider than either of the others and is partially composed of immense quantities of timber which has floated down the streams in connection with the lumber traffic. This timber is mainly composed of rough logs, stumps, limbs and refuse from saw mills. If one knew when the lumbering began along the Au Sable river, he could readily estimate the rate at which the last terrace is forming.

To all appearances the southern peninsula of Michigan at this latitude is moving eastward. The west shore is scarcely wasting away as fast as the east shore is gaining by sands thrown out of Lake Huron.

To return to the flora of the two opposite shores, I give the following list of *northern plants* which were found on the east side of the State and not on the west side.

Ribes lacustre Poir. Swamp Gooseberry.
Kalmia augustifolia L. Sheep Laurel.
Kalmia glauca Ait. Swamp Laurel.
Dracocephalum parviflorum Nutt. Dragon-head.
Picea alba Link. White Spruce.
Sparganium simplex Hudson.
Carex Backii Boot. Sedge.
Carex sterilis Willd. Sedge.
Carex capillaris L. Sedge.

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Carex Houghtonii Torr. Sedge.
Botrychium Lunaria Swartz. Moonwort.
Botrychium simplex Hitchcock. Moonwort.

The following southern plants were found on the west side and not on the east side.

Acer dasycarpum Ehrh. Silver Maple.
Rubus occidentalis L. Black Raspberry.
Sambucus Canadensis L. Common Elder.
Sassafras officinale Nees. Sassafras.
Ulmus fulva Michx. Red Elm.
Ulmus racemosa Thomas. Rock Elm.
Adiantum pedatum L. Maiden Hair Fern.

So far as the lists are extended they help sustain the prevailing notion that the west side of the State has the milder climate. True, we have not studied plants throughout the year, nor have all localities been searched. Possibly this, if complete, would be much modified. We might be able to see why silver maple, sassafras, black raspberry, red elm and rock elm thrive on the west shore and not on the east, but I am unable to see why the northern plants found on the east shore should not also be found on the west shore.

To some extent, the climate of the two shores of the southern peninsula of Michigan may be contrasted in the same manner as the climate of Oregon contrasts with that of Massachusetts. The difference on the two sides of the State are much less than they are on the two sides of the much larger continent bordered on the sides by broad oceans.

ANIMAL LIFE IN THE PINE WOODS.

[Notes under this head were prepared by my assistant, L. H. Dewey.]

We generally think that in the forests, far from the habitations of man, wild animals may be found in abundance. The pine woods of northern Michigan are usually supposed to be a paradise for the hunter. In some respects these ideas are wide of the truth. That there are many species, or that the species are represented by large numbers there, are mistaken ideas. In one day we will find on this College campus a greater number of species and, aside from certain insects, a greater number of individuals than we found last June in a two weeks' journey across the State.

Among insects, mosquitoes were numerous, by far surpassing all other species. Sand flies were occasionally felt. Spotted-winged deer-flies were abundant and hungry. There were numerous horse-flies, very much like those which we have here, except that they had two prominent yellow bands on the abdomen. At West Harrisville we found numbers of beetles resembling the June beetle, cut down to three-eighths of an inch in length. The lumbermen called them "pin worms," and said that the worms (larvæ) from which these beetles grew, bored into the pine lumber. In a few places we found a black species of the *Curculionedæ*, about three-eighths of an inch long. The inevitable bed-bug was found in a flourishing condition way out in the midst of the plains.

On the Huron shore at Harrisville, my attention was attracted the first morning we were out by the large size of the *Vanessa antiopa*. This butterfly was quite common throughout the eastern part of the State, and especially in the more heavily timbered land. The most common butterfly east of

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Grayling, or in the valley of the Au Sable, was the *Papilio turnus*, or large yellow swallow tail. In the western part of the State the *Danais archippus*, or milkweed butterfly, was most common. The *Papillio asterias* was quite common in the deciduous forests in the west.

The wings of a large white lunar moth were found in the dense mixed pine and hardwood forest of Kalkaska county. Very few smaller moths were noticed and not a *Hadena* or *Agrotis* was found.

In southern Grand Traverse county were many fine plum trees well laden with green fruit. The people owning them said that they had never been troubled by the curculio.

Very few bees or *Hymenoptera* of any kind were seen. A few miles east of Grayling there were a number of large ant-hills among the Jack-pines. They were rather flat and dome-shaped, four to six feet across and one to two feet high.

The Au Sable and the Manistee are both grayling streams. The grayling is a small fish something the shape of a perch, and is very fastidious in its habits. It will not remain in dirty water. For this reason we did not see any in the Au Sable, which was kept muddy in all parts by the driving of logs. The water was clearer in the upper Manistee, and the first night that we camped on this river, we had grayling for both supper and breakfast. It makes a very good dish, but it is probably its rarity and its gamy habits on the hook that give it such a great reputation. Farther west, in southern Grand Traverse county, we found many good trout brooks tributary to the Boardman river. In the small lakes along the route were plenty of rock bass, green bass and perch.

During the entire trip we saw a less number of reptiles than may be found most any summer day in a two hours' walk on the College campus. The dense cedar swamps were carefully explored without finding even a sign for a snake story. About six miles east of Grayling the rattle of a massassauga was heard.

Every night as our fire was lighted the cry of the whip-poor-will was heard in the neighboring brush. The whirring sweep of the night-hawk's spotted wings frequently broke the stillness in the deep pine forests. In the morning we were awakened by a note new to our ears. It came from the little white-throated sparrow; the same white-throated sparrow that is found in the Maine woods and of which Thoreau speaks in such enthusiastic terms. Its note has a very clear metallic sound that must be heard to be appreciated, and once heard it can never be forgotten. At three o'clock in the morning when all else in nature was asleep, this little early riser would send forth its sweet notes from the tree top. After sunrise its song would change slightly, losing just a little of its metallic ring and having one or two notes added.

In the Jack-pine plains, the only bird found was the robin, and less than a dozen of these were found in traversing more than fifty miles of the barren lands. One scarlet tanniger was seen in the timbered land of the Au Sable bottom lands, and one sand hill crane was found on the Manistee. A few wood-ducks and two or three loons were found on the little lakes. From Grayling through to Lake Michigan there were frequent instances of the work of the log cock. This is a large, black, red-headed woodpecker, which pecks out great holes in dead trees. The holes are most frequently in maple stubs and are often three inches wide by eight long and six deep.

Four-footed animals were exceedingly scarce. A few gophers were seen.

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Chipmunks were a little more numerous than the gophers. No squirrels were seen except red squirrels and they looked lean. They find that nothing but Norway pine cones for a living is too thin to leave margin enough to lay on fat, and most of them are emigrating to other parts. In the hilly region of Oscoda county numerous fox holes were seen.

There were three or four beaver meadows on the route, but no beavers have worked in this region during the last twelve or fifteen years.

About the only marks of the presence of deer seen were the beaten rings among the Jack-pines, which were said by the woodsmen to be made by the deers tramping around in them. None of these were fresh enough to show any tracks.

The howling of the wolves or the growl of the bear never disturbed our peaceful slumbers. We found places where bears had scratched upon trees. They will stand up by the side of a tree and scratch as high as they can reach with their fore paws. Woodmen call these "measuring trees."

WILD TREES AND PLANTS WHICH ARE ORNAMENTAL.

There is scarcely anything that grows in our swamps, plains, woods and fields that is not beautiful, when it grows in the right place or with right surroundings. Whether it seems beautiful or not depends also very much on the training of the person. In the catalogue of northern plants this feature of beauty is occasionally referred to. In this place I cannot help calling attention to the beauty of a mass of golden rods in bloom, surrounded on one or more sides by young hemlocks. A mass of red-berried elder twelve to twenty feet in diameter when in fruit is gorgeous and well worthy of notice. On a low perpendicular sand bank, the following are very neat and suitable: Either one of our three dwarf blueberries, three-toothed cinque foil (*Potentilla tridentata*), dwarf or sand cherry, trailing arbutus, and bear-berry. In September the scarlet oaks, dwarf huckleberries, dew berries, red maples, Virginia creepers and many others are often scarlet and make a fine display mixed with green and light yellow of tamaracks and poplars. Many other combinations were seen and could be mentioned.

SOME PECULIARITIES AND POSSIBILITIES OF NORTHERN MICHIGAN.

Many observations and numerous notes were made, among them the following:

The resources are many: a healthful climate, good water, plenty of timber, much excellent land and first-rate markets. The roads on the upland are usually good. For farming purposes, the land occupied by deciduous-leaved trees or hard wood is usually preferred.

Passing as we did through the centers of the counties of Alcona, Oscoda, Crawford, Kalkaska, Grand Traverse and Benzie, we could not help thinking that, with some exceptions, the west part of the State was better than the east side, especially when we consider the raising of orchard fruits. In the vicinity of Kingsley we saw many thrifty bearing apple orchards. Good land well covered with hard wood can be bought from four to ten dollars per acre, depending on the soil, timber and location.

Some of the land in eastern Kalkaska county has recently been stripped of all the timber, which was mainly pine. Much of this can be had for a dollar an acre and some or it goes back to the State for taxes.

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Railroads are not very numerous; neighbors are sometimes four to eight miles away, but in a good country all this will rapidly change. As an example of a new town, Mio is the county seat and largest village in the county, and contains perhaps one hundred people. The site was taken as a homestead in 1881; the town started in 1882. In 1888 they will hold their first county fair.

Pott's farm, in the western part of Alcona county, has a clearing of 140 acres which was mostly made fourteen years ago. It is hilly, well watered, and bears good crops. In the southern part of Grand Traverse, some settlements were made twenty or more years ago.

In some places the deep hollows in the sand are covered by large trees to the center. Such land, although hilly, is free from washing in time of rain or melting snow. In such places it is not unusual to hear of wells which are 60–144 feet deep.

Snow in many places cŏmes about the first of October, and goes off about May first. There is usually plenty of snow, and the view at times becomes rather monotonous. People in the southern part of the State think the summer season is too short for profitable grazing.

On May tenth, of this year, cattle were getting a good living in the pastures at Emira, which is in the northeastern part of Antrim county. They can feed in autumn till snow flies or later, from the fifteenth to the last of October. The soil does not freeze, so the land can be plowed as soon as the snow disappears.

There is considerable poor land, but much that is excellent. The deposits of marl are common, also peat; both of which may some day find their uses.

If land is to be cleared after cutting off the timber, it is much the easier way to clear it at once before allowing the sprouting stumps and second growth timber to cover the ground. This country, so free from weeds, ought to be an excellent place in which to raise seeds of grasses for meadow, pasture and lawn.

Large tracts of this land without any trouble, or but little, should afford much pasture for sheep. Of course provision must be made for winter feeding.

Much of this northern country, from Alcona to Benzie counties, appeared to us admirably adapted to dairying. Potatoes, oats, spring wheat, peas, grasses and clovers thrive admirably when properly managed on suitable soil. Berries, peppermint, and most likely other crops, could be grown there to perfection.

West of Mio we saw one man who reported success with his bees. There was plenty of basswood, also maples, raspberries, blackberries and other flowers which afford an abundance of good honey.

One serious trouble with the farming in this new country is the lack of experience and lack of means of many who are engaged in the business. They cannot work to advantage. They work on the farm a little, but mostly at lumbering. Many of those living there on small farms have been educated in other pursuits. They do not seem to understand that farming is a complicated business which for success needs a long and special training.

We consulted many enterprising men who were bound to win in their undertaking. From them we obtained much information and valuable hints to aid us in planning experiments on the pine plains.

In watching the rapid flow of the Au Sable and the Manistee passing by

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the plains which were thirsting for water, it often occurred to me, "Why not turn the waters on the fields and make them fertile, instead of using them to float logs to the lakes?" A thing so easily done, I believe one day will be done—and done with great profit—not likely by those owning small farms, but by those owning land by townships and sections. If we could control the water on these plains, so they should not lack for it, we could grow good crops, and with good crops the soil would rapidly improve in fertility.

The following with reference to the above subjects was contributed by Prof. L. H. Bailey, jr., and was clipped from two articles which he wrote for the *Free Press*:

"East of Gayling we find the typical plains.

"The soil of these typical plains is light sand, with the firm subsoil very low. In many places the soil is somewhat gravelly, but the gravel is loose and lacks substance. The plains are 'leachy' lands; that is, the rain is not retained long in the soil, but passes through rapidly into the subsoil, and the capillary power of the soil is so little that moisture does not rise from below to any extent. The filtration of water through this clean sand gives excellent water in the wells in all the plains region. For the most part the wells are shallow, ranging from ten to twenty feet. Most of the brooks, which, by the way, are very infrequent, contain sweet and pure water. These creeks and the rivers, most of which lie in considerable valleys, are fed by numerous springs along the banks, the drainage of the plains.

"While it is true that the characteristic plants of the plains are such as will not awaken the interest of the casual observer, there are some remarkable exceptions to this statement. Some of the plants are worthy a conspicuous place in the flower garden. The life root, or senecio of the plains, is very common in places, decking the dull surface with masses of golden yellow. The yellow puccoon, two sorts, is also conspicuous and attractive. Much of the barren land, especially on the eastern side of the State, produces great numbers of the large wake robin or trillium, a plant ordinarily found in low and rich woods. The bird's foot violet, the handsomest of the native species, gives the ground a bluish cast in some places, its great flowers appearing to delight in the aridity of the plains. Upon the plains of Oscoda county beautiful wild roses are abundant, the bushes sometimes attaining a hight of four or five feet and bearing a profusion of large and bright flowers. A species of New Jersey tea often whitens the slopes with its compact clusters. The occurrence of these plants cannot fail to inspire the hope that other plants of economic value can be made to grow profitably upon the plains. For the most part, however, these plants are such as delight in the poorest sands. The experimenter should seek rather to discover plants which naturally thrive upon loose sand than to attempt to cultivate here the ordinary plants of the farm and garden. Upon this line of experimentation the Agricultural College is working, with means derived from the operations of the Hatch law. Any plants of agricultural value which are adapted to sandy land will be given a trial upon one or all of the test farms. Already many plants from Europe and other countries are being tried, especially in the way of forage crops. It is to be expected that many of these plants will fail, but there is reason to hope that a few years will reveal some valuable acquisitions. Progress will necessarily be slow, and very likely the last to be benefited by the experiments will be those who live near the experiment farms. Already there are numbers of people who ridicule the plan of work and the methods employed, but they are among the ignorant classes, who are always jealous of progress. The plains lands are not yet in demand for farming purposes, and the experiment stations are therefore bound to do pioneer work. When the better lands are settled, it is probable that these stations will have determined a measurably profitable line of agricultural industry for the plains. In this work the stations will derive great aid from the few farmers who are attacking the problem single handed. It is not to be expected, however, that all the plains shall ever fall to strictly agricultural uses.

"Large tracts will be bought up by organizations of sportsmen for game reserves. When such tracts can comprise considerable diversity of surface and timber, with section of brook or river or lake, they are capable of making satisfactory ranges for game.

"The surface of the plains is diverse. It is mostly made up of a broad system of terraces which rises from the Au Sable, Manistee, Muskegon, and other rivers. Adjoining the river is an alluvial soil, variable in width, but usually confined to a few rods. From this rises a terrace of fifteen or thirty feet, leading to a level stretch of plain. Above this is another terrace, often higher than the first, and above this still one or two others. The width of the intermediate stretches varies from a few rods to a mile or

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more, until the hight of land is reached beyond the valley. The valley of Au Sable varies from three to five miles in width. The high lands to the rear of the last terrace are often one and two hundred feet above the river bed. They are mostly undulating in character, although, in many places, there are long stretches of perfectly level country. Some of these stretches which have been recently burned and over which the low herbage has again gained a foothold have the appearance of great pastures. One of these openings, fully two miles long, was passed through.

"It is to be borne in mind, however, that the plains do not comprise the whole territory through which the exploring party is making its progress. Nearly all of Alcona county is excellent farming land, fully as good as one finds in our southern tier of counties. The timber is hard-wood and mixed forest, with dense undergrowths quickly springing up in the clearings. The country is rolling and handsome, and comparatively well watered. We are informed that the northern half of Oscoda county is much the same, and there is considerable hard land in Crawford county. Throughout all the plains region there are occasional strips of hard land. The character of the plains soil itself is somewhat variable, some streaks of sand being much more fertile than others. Much of the pine land appears to be no better than the plains. It appears that a considerable part of the plains lands is made such by the action of fires, which prevent the trees from attaining a great size, for upon most of the plains one finds young Norways starting up and it is rare that there are not unmistakable evidences of fire having swept the country at one time or another. Before the plains can be reclaimed to the farmer for purposes of forestry and grazing there must be devised some means of lessening fires. Under the present slovenly and careless system of timbering there is little reason for hope in this direction.

"The logs are taken from the tree and all its remaining portions are allowed to remain where they fell. As soon as they become dry fire gets started in the slashing and spreads rapidly, burning over plains as well as timbered lands. What little herbage the plains afford is burned off, instead of passing into the ground to enrich it. In this manner a continual impoverishment of the soil is progressing. Lumbering and farming are largely antagonistic industries. At least one does not thrive in the presence of the other. The era of lumbering will be gradually followed by one of agricultural activity. In the meantime, the experiment stations will be doing good work. The sooner the lumber is taken out the sooner will the permanent prosperity of the country begin. The hardwood lands are in much less danger of injury from fire than the pine lands, and it is not so essential that they should be rapidly decimated of their timber. Most of the remaining pine forests are in imminent danger from fires, and it cannot be expected that they should stand much longer.

"The route for the afternoon lay through a variable country. The greater part of the journey, however, was taken through primeval forest of great luxuriance and beauty. It passed through several miles of mixed timber of which the predominant feature was the occurrence of mammoth white pines. The largest pine seen had a girth of sixteen and one-quarter feet at two feet from the ground. The finest white pines grow in these mixed forests, while the best Norways usually occur in continuous forests of that one species. In the magnificent mixed forests just noted the white pine does not comprise one-fourth of the total number of trees, yet lumbermen regard it as almost ideal white pine forest. The Norways grow straight and tall, their lithe and smooth trunks standing close together and presenting a picture of marvelous grace and beauty. Through these great primeval forests the roadway winds as a mere thread. At points the road is straight for a long distance, and the view down the long aisle, with its fleckered pillars of Norway, fading into deep shadow in the far distance, is grand beyond all description. At times the road plunges down great valleys into obscure masses of verdure, apparently losing itself abruptly in an overhanging ticket. Again it follows the highest ridges, which are often burned clear of all arboreal vegetation, affording the traveler broad views of the surrounding wilderness. This road is an irregular, winding one, occasionally blocked by trees and washouts, often very rough, but usually tolerably smooth, at least in the sandy lands. From Lake Huron to Grayling the thoroughfare is a neglected State road, cut out some twenty years ago. When we reached Kalkaska county it was found to take to the section lines in most places.

"Westward from the Manistee the country assumes a different character. Better land, more hardwood and occasional and prosperous farms give an attractive appearance to the country. The region is good farming land, the soil being sandy but abounding in vegetable matter. The forests are exceedingly dense and green and the undergrowth is luxuriant. The prevailing timber is hard maple, beech, elm and hemlock, just the admixture which indicates early and rich land. The swamps are filled with cedar and spruce, some of the former attaining great size.

"In the western portion of Kalkaska county the wild black raspberry was first seen.

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It had not been found upon the Huron shore nor upon the plains, although diligent search had been made for it. Its presence indicates a more southern cast to the region, a feature corroborated by the occurrence of other plants of a more southern range. Coming into the more settled portions of the county near Fife Lake apple trees in health and vigor were seen, and the few farms gave evidence of more intelligent management. The wild fruits of any region are an important indication of its horticultural possibilities. The wild grape is almost entirely absent from this tier of counties, the party having encountered it but two or three times during the whole journey. Even when found it grew among undergrowth where it was much protected, and it did not appear to fruit profusely. We should expect, therefore, that the garden grape, which has from a native species, closely allied to this seedling, can be grown only by protection. This protection is readily afforded, however, by laying the vines down in the fall, an operation practiced extensively in many more southern latitudes. Near Fife Lake a few cultivated vines were seen in a vigorous condition. The wild crabapple has not been found. It is usually observed that the culture of the common varieties of apples do not extend much beyond the range of the wild crab; but there is every reason to believe that many of the very hardy varieties may be safely planted here. The few trees now growing in this region appear to represent such varieties largely, the Ben Davis being prominent. Yellow, Transparent, Oldenburgh, Whitney, Seek-no-further and the improved crabs are to be recommended for this region. The wild blackberry is everywhere abundant between the two lakes, growing alike upon the plains and timbered lands. The wild red raspberry is frequent throughout. The presence of these species is indication enough that the country possesses possibilities in small fruit growing. It is commonly observed, however, that the cultivated raspberry and blackberry are injured by cold when the wild bushes in the immediate vicinity pass the winter in safety. The reasons for this are chiefly two. In the first place the natural protectors of the plants, the forests and wild bushes, are destroyed. The wind sweeps over the country with fury, driving the snow before it, and exposing plants to great vicissitudes of weather. If upper Michigan is to become a prosperous farming country natural windbreaks must be preserved.

The second reason for the more frequent injury to the cultivated plants is the fact that cultivation, unless properly pursued, causes a vigorous and somewhat softer growth which is unable to endure great extremes of climate. Wherever the soil is strong enough, currants and gooseberries will thrive. Two or three very small plantings of currants have been seen, and they are uniformly vigorous. In fact the wild red currant is common in the swamps, and other wild species occur. The wild gooseberry is also often seen. The wild plum is found at Mio and other places in Oscoda county, and a critical search would undoubtedly reveal it in other places. Both the red and yellow varieties occur near Mio. At Coming's Opening, on the Au Sable, a few wild plums had been transplanted. The common wild plum is exceedingly variable, and it is now being introduced into cultivation very largely. Many improved varieties are largely cultivated. All these will undoubtedly prove hardy and valuable here in this northern country. The sand or dwarf cherry grows abundantly upon the poorest plains. Its fruit is variable, but usually as large as a small grape. In flavor it is good to excellent. The plant is a low and straggling bush, seldom growing over five or six feet high. It is a profuse and reliable bearer. It requires no scientific training to predict that this plant has a wonderful future before it. If the few inhabitants of the plains had even a moiety of energy and a whit of observation this wild cherry would be found growing in every garden. At present even the garden is usually missing. If the inhabitants want anything in the line of fruit they will have the old varieties of more favored latitudes or they will have none. In this happy state of affairs their lot will be to have none. The sand cherry it is admitted, is not a Governor Wood nor a black heart, but it is good and wholesome, and is capable of great improvement. It thrives in the poorest and driest sand, and is not injured by any extreme of climate. Its possibilities for the plains are great. Another promising plant of the plains is the wild dwarf service-berry or June-berry. The fruit closely resembles a huckleberry, and the plant is often sold for such by ignorant and unprincipled nurserymen. The bush is comely and attractive, growing from four to eight feet high. Of late years it has been introduced into cultivation. As soon as its merits are better known, its culture will become common in all cold climates. Three species of huckleberries, closely following each other in periods of ripening, are everywhere exceedingly abundant on the plains. As soon as markets become more accessible there is no doubt that these berries will become a profitable crop on the barrens. It will be only necessary to inclose the land and to remove other vegetation in order to grow them with profit. On the whole the horticultural outlook is more encouraging for our barren plains than for the rich prairies of many parts of

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the Northwest; an outlook, however, which depends upon the hope that the country will never be denuded of all its forests.

"The whole business of lumbering impresses one as exceedingly slovenly. Every move of the ordinary lumberman proves that his desire is to skin the country, to pocket the 'almighty dollar,' irrespective of the ultimate and permanent damage wrought to the country. Your reporter, for one, can entertain little respect for the man who buys his land solely for the timber it contains, slashes off the forest in the most reckless manner, and then allows the denuded and devastated land to revert to the State. He has seen many lands for which lumbermen paid $100 and more per acre, it is said, but which are now in the general market for $5 and less per acre, and yet they are lands which once contained sufficient fertility to render them valuable for agricultural purposes.

Tuesday afternoon the expedition passed through an inviting country east of Fife Lake. Occasional swamps relieved the monotony and afforded the botanists an opportunity to plunge earwards into mud and mosquitoes. But the swamps yielded rich harvests. One bog presented in abundance one of the most beautiful and rarest of wild orchids, the little Arethusa. Everyone could see beauty in this shy flower, and could feel something of the tingle of excitement and adventure which appeared to overtake the botanists at regular intervals."

Northern Michigan presents to me new advantages every time it is visited. The neat, new schoolhouses deserve especial notice, as they are an index of the character of the people. The fruit trees and the farming are retarded a week or more in spring when situated near either one of the great lakes. This has more advantages in case of fruits than at first sight might appear. On June 13, 1888, at Harrisville on the margin of the lake, trees of Kentish cherry were just in flower; the same was true of the common sorts of apples, Missouri currant, and dwarf phlox. The flowers of the common lilac were still in the bud.

In brief, we were surprised to find so many advantages for people of limited means to start homes. We are unable to see why so many should leave Michigan for the prairies of Dakota, and believe most of them would not thus leave were they familiar with the better portions of our State. But we should not be in great haste to see this State thickly settled, for our sons and grandsons and their wives will soon want the cheap lands and will convert them into pleasant farms.

W. J. BEAL,
Botanist of the Station.

AGRICULTURAL COLLEGE,
June 30, 1888.

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REPORT OF COMMITTEE ON DAIRY EXPERIMENTS FOR EXPERIMENT STATION.

Early in the spring the Board of Agriculture appointed two of its members, Messrs. Chamberlain and Horton, a committee to visit some of the leading agricultural colleges and experiment stations for the purpose of learning what lines of dairy experiments were being carried on and what were the plans for future work, that we might have the benefit of their experience in deciding upon a line of dairy experiments at this station.

Business prevented Mr. Horton from taking the trip, and Prof. Johnson was appointed to go in his stead.

The following report of the trip was made by the committee to the Board:

On May 1 we left Chicago for Madison, Wis., where the State University, having an agricultural department and an experiment station, is located. This station has been liberally supported by the State for some years, and will now receive the Hatch appropriation.

Prof. W. A. Henry, the efficient director of the station, was at home and showed us the dairy house, barns, silos, etc. The dairy cattle were ordinary grade Jerseys, Holsteins, Ayrshires and Shorthorns. Chemical tests of milk and dairy products and cattle foods, in connection with the new dairy house, and practical tests in details of dairy management with all the modern appliances and skilled help, will be the principal line of work at this station.

The following questions will indicate the points upon which we desired to secure information:

1. What line of dairy investigations will you pursue, cheese or butter, or both?
2. Will you test the comparative value of the two methods of setting milk, or by centrifuge separate the cream from the milk?
3. Will you test dairy apparatus?
4. What practical work in feeding and in testing milk of different breeds will be attempted, and will be advisable?
5. What are the questions that most demand attention in dairy husbandry that the stations should undertake to answer?
6. Is it essential to have a model dairy house with full appliances for station experiment work?
7. Should a scientific professor of dairying have charge or a practical cheese or butter maker?

We next visited Mr. Hiram Smith, the veteran dairyman of Wisconsin, at his home near Sheboygan Falls. Mr. Smith is a firm believer in dairying for profit, and thought that a model dairy house for experiments would be a necessity at all stations. He estimated the cost of building and exquipment at

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$2,000. He thought the most pressing work was testing milk, different methods of setting and churning, and feeding tests to determine what foods are best adapted to produce milk of good quality on a paying basis. He could teach young men, in a week, to make as good butter as milk will make. Would rather teach a car load of young men anxious to learn than one old yankee who had made butter for 25 years and has nothing to learn.

At Ames, Iowa, there has been but little work planned in dairy experiments. Next year they intend to build a new dairy house and will do more in this line.

Our next visit was at Guelph, Ont. We were much pleased with the Dominion plan of dairy experiments, as is Mr. Robertson the Professor of Dairying. Prof. Robertson is employed at a yearly salary of $1,750, devotes a part of his time to College work and the remainder to Institute work. There are two dairy inspectors appointed at a salary of $800 each, and under these are 8 assistants in charge of the work in as many sections. These are paid by the Dairyman's Associations of the province, and their work is to give instruction to the makers of cheese and butter in the respective districts. Prof. Robertson says: "It is not so much our purpose to instruct students as to foster the dairy industry and encourage those engaged in it to adopt the best appliances and methods, and to do it as far as we can in an unofficial way." Prof. Robertson thought, as did all with whom we consulted, that a model dairy house with all modern appliances would be indispensable in experimental work. He thought there would be no difficulty in finding a man skilled in all the details of butter and cheese making for from $50.00 to $75.00 per month, and for the special experimental work he would depend upon the Experiment Station officers. He would prefer a practical butter or cheese maker rather than a scientific one. He believes that feeding experiments to test breeds and the fodders best adapted to make good returns in quality and quantity of milk, promise to be of great advantage to the dairyman.

From Guelph we journeyed to Geneva to visit the New York State Experiment Station.

We enjoyed a drive to the John Johnston place and a pleasant call on Mr. Swan, a recent member of the board of control of this station. This gentleman gave it as his opinion that experiments in the line of feeding to test breeds and the testing of different fodders both for milk and beef production would be of more advantage to the farmers than any other line of work in which the stations could engage. Dr. Collier, the new director of the station, is planning for such experiments, following the line of our work with steers of the different breeds and adding heifers brought up under like conditions to test dairy qualities. The demand in New York on the part of the farmers was for work of this kind.

At this station we found the best and most orderly dairy house we saw on our trip. It was equipped with the modern appliances, centrifuge, Cooley creamery, Stoddard churn, cool storage, etc.

Cornell station and university received the next visit. Cornell receives the National appropriation, while the Geneva station is supported by the State.

The stock, Holstein grade cows, was in good condition, and is kept solely for milk production. The milk is sold for 5 cents per quart and is a profitable product at that price. A dairy house, supplied with all modern appliances, was recently erected, but no work had as yet been undertaken.

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At Amherst, Mass., the stock was in good condition and the barns and stables neat and clean. Little has been done in dairy work here, as yet. Foods of different sorts were being fed to milch cows to determine their value in milk production. There seemed to be order and method that would be likely to secure accuracy in the work.

Dr. Goessmann, the director of the station, lays great stress upon the value of feeding experiments, properly conducted, and devotes a large part of the station work to them.

We visited two large factories in central New York, one manufacturing cheese, the other butter; and also the famous farm of Burrill and Whitman at Little Falls, N. Y. They milk some 300 cows and depend largely upon ensilage and soiling crops for food. They have a large and excellent herd of Holsteins.

We regret that a pressure of business demanding personal attention made it impossible for Mr. Horton to take the trip. His long experience in the details of dairying would have been of great service in securing the information we desired.

We were somewhat surprised at the small amount of work that had been done in dairy lines and the vagueness of the ideas and plans in regard to it at some of the stations. We were most courteously received everywhere, and every opportunity afforded us to obtain information.

The committee submitted the following recommendations which were adopted by the Board of Agriculture:

1. Your committee respectfully recommend for your consideration, that in view of the great and growing importance of the dairy interest, its present and prospective development in our agriculture, that it should receive, as we doubt not it will, generous considerations in your plans for future experimental work.

2. In view of the facts already stated and in deference to the views of the experienced men we met at each of the stations, we recommend that steps be taken as soon as practicable to build a model dairy house—not for commercial dairying but for experimental work in both cheese and butter, and equip it with the best apparatus and fixtures that can be procured. We estimate the cost of such building and equipment at from $2,000.00 to $3,000.00.

3. We further recommend the purchase of heifer calves of each of the leading breeds, and one pair of natives, to be fed and cared for under same conditions up to time of calving, with a view of testing as to quality and quantity of milk, its adaptation to cheese and butter production, also the value of the refuse or by products for feeding calves and swine.

4. We further recommend that some plan be devised by which the station may co-operate with the State Dairyman's Association, in manner similar to the plan now pursued in the province of Ontario.

HENRY CHAMBERLAIN,
SAM'L JOHNSON,
Committee.

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BULLETINS.

The operations of the departments of Agriculture, Horticulture and Veterinary Science are reported in the bulletins issued by them; reprints of which follow. These bulletins continue the series begun in 1885, a complete list of which is given herewith, together with the volume and page of the Reports of the Michigan Board of Agriculture in which they are permanently bound.

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37	Chemical	June, "	Jack pine plains	"	
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42	Veterinary	Nov., "	Oxygen treatment for horses	"	

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NO. 34.—FARM DEPARTMENT.

EXPERIMENTS WITH POTATOES AND OATS.

POTATOES.

The soil on which the potatoes were grown was a sandy loam which had been in wheat plats for the two preceding years. The soil was not manured immediately before the potato crop, but had been enriched with barn-yard manure freely for several years previous. The land was plowed seven inches deep, harrowed and marked with furrows four inches deep and three feet apart each way. The potatoes were cut into pieces having from three or four eyes each, or in case of small potatoes, cut into two pieces, and planted one piece in each hill. The cultivation was thorough during the season. The "Iron Age" five tooth cultivator was used, giving a level cultivation, and keeping the ground free from weeds. The dry weather was very severe, especially on some of the earlier varieties. The later varieties received some benefit from the fall rains.

Nos. 1, 2 and 3 are rather shy growers and produced quite a large per cent of small potatoes. These three varieties are among the earliest; they were budded in aboutthirty days from time of planting.

Nos. 5 and 6 are very vigorous growers, especially the former. According to notes taken this and previous years No. 6 proves to be quite a favorite with the potato beetle. This may be due to the fact that by making a more vigorous growth than some of its neighbors, it produces more tender shoots, which are always sought for by the beetle. No. 5 has again given better returns than any other variety grown. It maintained a vigorous growth during the dry season, and, as seen in the annexed table, gave a better yield than any other variety. It is a good keeper and one of the best varieties for table use.

Nos. 7, 9 and 10 are promising varieties. These have not been tested as thoroughly as No. 5.

Among the medium ripening varieties we would mention No. 15 as being one of the best. This variety does not grow quite as smooth as some of the others and the tubers are not of quite as good shape as some other varieties, but after several years of trial its merits are obvious.

Of the late varieties Nos. 11, 12, 13 and 14 are all good yielders and vigorous growers. No. 14 has a pinkish color which is objectionable to many. The vines also take a dark color. No. 11 is one of the best late potatoes in the list. No. 17 has usually been one of the best, but this year is a decided exception, both in the field and in the experimental plat. No. 16 resembles No. 14 very much.

The Polaris is a new variety sent out by the Department of Agriculture. It is a handsome potato, smooth and white. We planted four potatoes cut into thirty pieces, making thirty hills; from these we got 30 lbs. of very fair potatoes.

The experiment with different amounts of seed is one which has been repeated on the College farm for three successive years, with about the same results. Last year being a very dry one was a crucial test for the one eye plat. Many of the pieces dried up, failing to grow entirely, or in sending up a very feeble growth, were not vigorous enough to stand the drouth.

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There was a regular gradation in vigor of growth from the one eye up to the whole potato. The one eye plat produced a larger per cent of small potatoes than usual, in fact there were very few fit for the table. Those from two eyes were a little better in this respect, and the per cent of small potatoes reached the minimum in the three eyes and one-half potato plats.

There was a much larger yield in the aggregate from the whole potato, as seen in table. The per cent of small potatoes from this plat was less this year than in previous years.

The tubers were entirely free from rot when harvested, and, with the exception of quite a large per cent of small potatoes, they were of very fine quality throughout. This applies to all the plats and varieties.

Name of Variety.	No of plat.	Date of planting.	Date of harvesting.	Early, medium, late.	Size of plat.	Yield of plat.	Yield per acre.
		May.	Aug.		Acre.	Bushels.	Bushels.
Vick's Extra Early	1	9	25	E.	⅛	8.67	69.33
Lee's Favorite	2	"	"	"	"	12.30	98.40
Early Harvest	3	"	"	"	"	11.33	90.67
" Telephone	4	"	"	"	"	10.65	85.20
Beauty Hebron	5	"	27	"	"	16.80	134.40
Early Mayflower	6	"	"	"	"	12.30	98.40
Clark No. 1	7	10	Sept. 19	"	"	13.67	109.33
Garfield	8	"	20	M.	"	8.28	66.24
Chicago Market	9	"	"	E.	"	14.87	118.93
Alexander's Prolific	10	"	"	M.	"	15.00	120.00
White Star	11	"	"	L.	"	15.80	126.40
Thorburn	12	"	Oct. 21	"	"	16.13	129.07
Mammoth Pearl	13	"	"	"	"	14.80	118.40
Dakota Red	14	"	13	"	"	16.17	129.33
White Elephant	15	"	"	"	"	14.00	112.00
Rural Blush	16	11	"	"	"	11.50	92.00
Burbank Seedling	17	"	"	"	"	6.85	54.80
Polaris	18	12	Sept. 19	E.	30 hills.	.50	80.67

Amount of seed in each hill.	No. of plat.	Date of planting.	Date of harvesting.	No. of hills planted.	No. that grew.	Per cent that failed.	Yield.	Quality — 10 perfect.
		May.	Oct.				Pounds.	
From 1 eye	1	12	13	85	77	9	50	4
" 2 "	2	"	"	"	81	5	71	5
" 3 "	3	"	"	"	82	4	86	7
" ½ potato	4	"	"	"	83	2	90½	8
" whole potato	5	"	"	"	85	0	117¼	9

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OATS.

Varieties Tested.

Waterloo.	White Russian.
Welcome.	" Victoria.
Triumph.	Harris.
Monarch of New Zealand.	Short Club.
State of North Dakota.	Norwez.
New Race Horse.	Yellow Etherian.
Millard's Kansas.	Florida.
White Dutch.	Somerset.
" Poland.	Black Russian.

While the experiments in growing several varieties of oats on the College farm were cut short by the long continued drouth, and were therefore not altogether satisfactory, they helped to establish the fact that there is very little difference, if any, in many of our so called varieties.

The Welcome, Short Club, Monarch of New Zealand and White Victoria have about the same length of straw, ripen about the same time, are nearly awnless and they all bear a short, plump, white grain. It would not require much imagination to place them as one and the same variety.

Out of eighteen varieties only four or five promise any great degree of success in this latitude. These varieties are the White Poland, White Victoria, White Russian, Welcome and Monarch of New Zealand. The principal characteristics of these varieties are good length of straw, light chaff, and large and heavy grain.

Another point which was brought out more clearly on account of the dry weather, perhaps, was the resemblance of some of the poorer varieties to the wild oat *Avena Fatua.* Among these we would mention the Florida, Norwez and Harris. These have dark grain which bears long, dark twisted awns that take about the same shape as on the wild oat. In the wild species there are numerous hairs grown on the floral glumes; these are absent in case of varieties named. The straw is slender and the empty glumes are quite persistent.

After repeated trials with many of the so called new and improved varieties of oats, I am compelled to say, that in my judgment, not one of them is superior, if equal, to the common white oat for general cultivation. In yield and quality of grain and straw, it has year after year made a most favorable showing in comparison with any of the new and much advertised sorts.

I believe if farmers would expend a little of the effort and money used in finding and testing new varieties of oats, in the securing of clean seed, of first quality, of *the same variety they have grown* and which they *know is adapted to their locality,* but grown on a *different soil* and in a *more northern latitude,* and leave the testing of new varieties to the experimental stations, until trials for successive years had proven the adaptation and value of a new sort,—it would be greatly to their profit.

Some experimenters are too ready to vouch for new varieties and to express positive opinions on very short acquaintance. It were better to remember Davy Crockett's advice, " Be sure you're right, then go ahead."

I have recently received letters from farmers, inquiring as to the value of varieties of oats and corn, that were being offered in their localities, as great

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acquisitions. Glowing inducements are held out to persuade the farmer to buy or take seed on shares and pay from the proceeds of a prospective crop. It's the old game of Bohemian oats, worked under a new name and with some change of methods.

It seems to me, after the experiences of the last ten years and the emphatic and repeated exposures of these seedmen and their fraudulent practices, at the hands of the press in general and of the agricultural press in particular,—that a farmer who will stop for a minute to banter with an itinerating seed peddler is a fit subject for a guardian if not for a lunatic asylum. If his cupidity leads him to invest, expecting to get something for nothing, does he merit any sympathy if he is plucked?

The fact is, seed peddling has come to be a very disreputable business, and the best public sentiment everywhere brands the itinerant seedman as a fraud of the first water. May I not add that it is disreputable to have anything to do with him?

If new varieties of seeds are needed and cannot be obtained from the growers in your own neighborhood, the safe way is to order from one of our many reliable seedsmen, who advertise in the columns of our reputable farm journals, who are responsible for their statements and the quality of their offerings, and do their business in a legitimate way.

Notes on the potatoes and the oats were taken by Sophomores Palmer, Curtis, P. G. Holden, Rice, Rhonert and Earl during the season of growth and have furnished some of the data used in this bulletin.

My assistant, Mr. Hiram T. French, had charge of the work on the experimental plats and has rendered me valuable service in the compilation of this bulletin.

SAM'L. JOHNSON,
Prof. of Agriculture.

FARM DEPARTMENT,
AGRICULTURAL COLLEGE, March 10, 1888.

No. 35.—WEATHER SERVICE DEPARTMENT.

REPORT OF THE DIRECTOR.

Statement of Account, Showing Amount of Appropriation and Total Expenditure of Each Specific Account for Year Ending Dec. 31, 1887.

MICHIGAN WEATHER SERVICE.

Name of Account.	Appropriated.	Expended.
Incidental expense	$350 00	$342 20
Telephone and telegraph	2,000 00	1,468 27
Instrument	2,087 50	2,087 50
Salary	800 00	711 12
Weather signal	200 00	200 00
Balance		628 41
Footings	$5,437 50	$5,437 50

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LANSING, MICH., January 18, 1888.

To Hon. Franklin Wells,
President State Board of Agriculture,
Constantine, Mich.

SIR:—I have the honor to submit the following report of the work of organization of the Michigan Weather Service for the year 1887:

The service was placed under the charge of the State Board of Agriculture, by the provisions of Public Acts, No. 2, 1887, State of Michigan, and has continued under the control of this Board since Feb. 3, 1887, when the Act above referred to was signed by the Governor.

By the provisions of said Act the Board appointed Sergt. N. B. Conger, signal corps, as Director, and E. H. Nimmo as Assistant to the Director at a salary of $800 per annum.

The office force has remained unchanged during the year.

Mr. E. H. Nimmo has proved a very faithful and efficient assistant and has performed all work assigned him with promptness and ability.

Instruments.—Fifty sets of instruments were purchased Feb. 16 upon the order of the Board by the Director, and have been issued at different times during the year, until now there still remain unused 9 barometers, 2 exposed thermometers, 2 wet-bulbs, 1 maximum, 2 minimum thermometers and 1 rain-gauge. Two instruments were broken during the year, 1 wet-bulb and 1 maximum thermometer.

The value of the wet-bulb, upon recommendation, was remitted to the observer breaking it as an accident, and the money for the maximum was used to purchase one to replace it by the observer breaking it.

Receipts for all instruments issued to voluntary observers are on file at the Central Office.

Railway Weather Signals.—The appropriation of $200 made for this purpose was exhausted in the purchase and manufacture of 26 complete sets of signals which are displayed daily except Sunday on the following roads:

Detroit, Grand Haven & Milwaukee Ry	2 sets
Chicago & Grand Trunk Ry	2 sets
Port Huron Division, Grand Trunk Ry	2 sets
Michigan Central Ry	11 sets
Port Huron & Northwestern Ry	3 sets
Grand Rapids & Indiana Ry	2 sets
Chicago & West Michigan Ry	2 sets
Pontiac, Oxford & Port Austin Ry	2 sets

These signals are carried on the first passenger train leaving terminal points in the morning. This method of distributing the indications and cold wave warnings has met with marked success on these roads, farmers placing great confidence in the information thus indicated.

The Director wishes to here take the opportunity to express his thanks to the following named gentlemen for their hearty coöperation with the service in displaying these signals:

A. B. Atwater, Gen'l Supt. D., G. H. & M. R., and C. & G. T. Ry.
E. C. Brown, Gen'l Supt. Michigan Central System.
J. M. Metheany, Gen'l Supt. G. R. & I. Ry.
J. K. V. Agnew, Gen'l Supt. C. & W. M. Ry.
I. R. Wadsworth, Gen'l Supt. P. H. & N. W. Ry.
James Houston, Gen'l Supt. P., O. & P. A. Ry.

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Weather Signals.—There are now in operation 142 stations displaying weather and temperature signals in the State. These stations purchased the flags for display and the indications are furnished free by the service. Forty stations are furnished by the U. S. Signal Service, and 75 by this service, and the remaining 27 are furnished free by the coöperation of the C. & G. T. Ry., G. R. & I. Ry. and the Michigan Postal Telegraph Co. In October, 10 stations were discontinued for not furnishing the monthly reports.

These weather signals have met the popular demand for daily weather indications, and have been quite successful during the year.

Some difficulty has been met with on account of displaymen not forwarding the required monthly reports, and some plan should, I believe, be adopted to compel the displaymen to forward them, as they are a record of the receipt of the indications and also a record of what benefit the indications are to each locality where the signals are displayed.

Under this heading it will be proper to state that a telephone has been maintained in this office since February 3, at the expense of this service, and is constantly used to transmit indications to the several districts in the State.

I would also state that of the 40 stations maintained by the National Service, 20 are supplied by telegraph and 20 by telephone. By an arrangement with the Michigan Bell Telephone company, approved February 22, by the Board of Agriculture, the indications and cold wave warnings were to be supplied to such stations as the Director might designate, at a rate not to exceed $25.00 a year to each station so supplied. This generous offer allowed the Director to reach a much larger number than could have been done at commercial rates. The general comment on the reports received at this office is that the weather signals were a success for the year. The average percentage of the indications verified during the year was 83.

Voluntary Observers.—The Director takes pleasure in stating that the corps of Voluntary Observers of this Service is a very valuable one and to them belong in a great measure the credit of the success attained in this branch of the Service. There are on the records of this Service 148 voluntary observers, of whom 82 report temperature, rainfall, direction and force of wind and state of weather, and 66 report rainfall only. When the first report of this Service was issued for the month of February there were 12 voluntary observers and 8 of the U. S. Service; in the last report issued for December there were 78 voluntary observers and 8 of the U. S. Signal Service. This alone shows much progress and a solid standing at this date. Some difficulty had to be overcome in case of persons volunteering to take the observations, who after receipt of instruments, would furnish no reports to this office. These are being eradicated as rapidly as possible. It is but just to say, however, that this class represent a very small portion of the whole.

The reports of these observers upon receipt at this office are carefully examined, proved and a portion tabulated and published monthly in the Michigan Crop Report, as provided by the Act. These tables contain now the following data: 1st, Table of mean Daily and Monthly Temperature for each station. 2d, Daily and Monthly Precipitation. 3d, General Tables, containing mean barometer and temperature records, highest and lowest temperatures, monthly rainfall, number of "clear," "fair," "cloudy" and "rainy days," for the month. This tabulated work has been found valuable to all classes and especially to the agricultural interests of the State. 4th, Report of weather signal display stations. The text of this monthly report

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covers the important features of the climate during the month of which it is a record.

The Director is now compiling the daily mean temperature and precipitation for Michigan, from 1875 up to date. It is considered that this will be of great value to the agriculturist especially, during the coming seasons. This is a new departure, as there are no such records now available to the knowledge of the Director, and it will enable any one to ascertain from the reports the deviation of the temperature and precipitation each day from the normals of 13 years.

Weather Crop Bulletin.—From May 7, 1887, to October 24, 1887, there was issued weekly on Monday a bulletin giving the effect of the weather and temperature upon the different cereals during the previous 7 days. This bulletin was favorably received by the farmers, and will be continued the present season (April to October). This bulletin in no way encroached upon the monthly report issued by the Secretary of State, but simply treated of the climatic effects upon grains and grasses.

The organization of this Service is now nearly completed, and is I believe a model one. It certainly has taken great strides toward a successful and solid foundation, and the value of it will soon become apparent to all classes of citizens. In this connection I would digress and quote from a letter of the Chief Signal Officer in connection with my annual report to him of this work. Lt. Dunwoody states in transmitting this letter: "It is well merited, as you have in a single year, organized the most thoroughly equipped State Weather Service now in operation, and the benefits of the Signal Service by this means have been extended to many sections of the State not previously reached." I quote this not for myself, but to show what is thought of *the Service* by the Chief Signal Officer.

In closing this report I wish to express my thanks for the hearty and substantial aid extended me by the Board of Agriculture, and to state that my one ambition in this matter was to organize the best Weather Service in operation, and if, in striving for that object, I have at times overstepped the bounds of my position, I have done it unwittingly and only in behalf of the Service. The outlook for the future is very bright and I trust no unforeseen danger will retard the progress it is now making. I believe the coming year will show a substantial return to the people of Michigan for the liberal appropriation made for carrying out this object.

Of the 84 counties in the State all but 5 are now supplied with instruments for taking observations and reporting climatic changes, and the succeeding years will be laden with valuable statistics from all portions of the State on this important subject.

Very respectfully,

Your obedient servant,

N. B. CONGER,

Sgt. Signal Corps, Director.

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NO. 36.—VETERINARY DEPARTMENT.

EXPERIMENTAL WORK AMONG CATTLE.

For many years the operation of spaying cattle, as well as other animals, has been practiced in most parts of the world, gaining much favor in many instances, so much so that claims have been made regarding its advantages, which if true, place it among the most economical methods of treating cattle when they are intended for the shambles, or in milch cows when their owners desire to increase the period of lactation. Such claims have very naturally led owners as well as dairymen and others to enquire into the exact per centage of gain, if any, that can be reasonably expected from the operation; but as systematic experiments have not been conducted on a large scale to determine the veracity of the various claims, the questions cannot be answered, except in a very general sort of way, so the Veterinary Department of the Michigan Experiment Station, is desirous of conducting a series of experiments among cattle for the purpose of testing the merits of spayed heifers, against unspayed animals, and thus determine whether those spayed, at say one year old, mature earlier, or are ready for the shambles sooner than their unspayed neighbors; also whether they will produce a superior quality of meat, making it tenderer, juicier, and more palatable, and thus increase the intrinsic, or market value.

Besides the above it is the desire to test the spayed animals, side by side against the unspayed, to determine if they fatten sooner or better upon the same quantity and quality of food, and if they do increase, the exact amount of the increase, will be determined and recorded. The effect of the operation will also be tried upon milch cows of various ages, to test first of all its influence upon their meat, and also to discover if possible how long it will take for the beneficial change (assuming that there is one) to occur.

Again it is desirable to know how long the period of profitable lactation will last; and to test the quality as well as the quantity of the milk, for an extended period, say a year or two, or even more.

To carry on these experiments on a sufficiently large scale, to be of any practical value to agriculture, and the public, would necessitate a larger cash outlay than can at present be devoted to this branch of the experimental work; so it is proposed to establish a number of sub-stations, where the work can be conducted at the minimum of expense, and those who may be interested are invited to aid in carrying these experiments through. The conditions upon which they will be conducted are:

1. Not less than ten animals will be put into one experiment at each sub-station. (The animals need not necessarily belong to one man.)
2. The experiment to continue through a period to be agreed upon, say two or three years.
3. The animals will be listed, and monthly or quarterly records kept of their weight, and other conditions, for which a book will be supplied with the necessary headings.
4. Reports will be made from these books by the Veterinarian of the Michigan Experiment Station, from time to time, and they will then be put on record.

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5. The Experiment Station will send its Veterinarian to perform the operation, and give general directions regarding the care and management of animals in the experiment, *free of charge.*

6. Owners of animals in the experiment will be required to provide fodder, as well as general care and management of the said animals, at their own expense.

7. For the present it will only be upon farms where facilities for weighing the animals, from time to time, can be obtained, that sub-stations will be established.

8. Sub-stations will only be established within five miles of a railroad having direct communication with Lansing, Mich., and within a radius of seventy-five miles of that city.

As there may be those who wish to know more concerning the operation of spaying, I will say, for information, that it consists in removing the essential organs of generation from the female, namely the ovaries. When this is done the process of breeding is most effectively stopped, as is also that periodical desire for the male which renders some animals very irritable, and even dangerous. It also does away with that condition known as Nymphomania, during which the female is a perpetual nuisance owing to the persistence of the "heat," and consequent desire for male intercourse; this disease is so exaggerated in some animals that their pecuniary value becomes much affected. By the removal of these glands (the ovaries) the docility of the female becomes permanent, which is probably the key-note to other advantages, especially the tendency to lay on fat, for when we put that fretful condition, that occurs every now and again, forever in abeyance, it is only natural to suppose that the animal will continue to lay on the avoirdupois, day after day without interruption, which surely must give it some advantage over the unspayed animal, *but how much* is yet to be determined. With regard to the influence of this operation upon the milk of the cow, it seems reasonable to suppose that when the nervous disturbance occasioned by the periodic appearance of the "heat" is permanently removed, that the gain in the quantity as well as the quality of this fluid must be considerable, that is when the estimate is taken through a period of say one year, but just what the gain is, in actual measurement of quantity, and analysis of quality, has yet to be discovered.

Those who wish to take part in the experiments proposed in this bulletin, or those who wish further information upon the subject, will please address

E. A. A. GRANGE,

Veterinarian to the Michigan Experiment Station,

MICHIGAN AGRICULTURAL COLLEGE,
May 1, 1888.

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NO. 37.—CHEMICAL DEPARTMENT.

THE JACK PINE PLAINS.

The large amount of light sandy soils in some of the northern counties of Michigan which do not appear to respond favorably to ordinary methods of tillage, seems to call for investigation and experimental inquiry. Some persons doubt the possibility of their successful cultivation and are disposed to scoff at all attempts in that direction. The fact that many persons have settled on these lands for homesteads and after a few years have abandoned their claims and gone elsewhere for permanent homes, seems to countenance the doubt about their agricultural value. The hundreds of abandoned homesteads give sad evidence of misdirected labor and disappointed hopes. Some have asked, why raise expectations which shall cause others of small means and who are ill able to bear the loss of their little capital and years of fruitless toil to embark in an enterprise which will end in disastrous shipwreck? The answer is obvious: if these plains are incapable of cultivation, then in mercy to the homesteader and men of small means, make it clear and plain that the plains are worthless for farming, and thus prevent their entering upon a hopeless undertaking; if previous failures have been in consequence of wrong methods of tillage, kinds of crops, etc., then make this plain and point the way to successful farming on the plains. The homesteader can not bear the expense or spare the time for such experimentation; the government having hundreds of thousands of acres of these lands on its hands can well afford the means for thorough investigation of this subject.

THE PROBLEM STATED.

The question for present consideration is, how to bring these lands into profitable cultivation by such methods of tillage and the use of such manurial materials as are within the reach of every farmer of moderate means. It does not include the use of stable manure, for the reason that this can not at present be obtained in sufficient quantity to supply the needs of the plains. No one need doubt the capacity of these sandy soils to produce crops if a sufficient supply of stable manure can be obtained. The first question is, how to raise the crops on these lands that shall furnish the stable manure.

The present inquiry does not take account of possible results by the use of commercial fertilizers and imported manures. There is little question that with the free use of superphosphates affording abundant supplies of potash, phosphoric acid and ammonia, large crops can be produced on these plains. The lavish expenditure of money for the production of crops without consideration of the cost is as worthless as it is extravagant. Such commercial fertilizers are beyond the means of the pioneer and homesteader, and hence outside the present inquiry.

The problem briefly stated is this: with a light sandy soil of very porous quality, in a northern climate subject to late frosts in spring and early frosts

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in autumn, and liable to midsummer drouth, with no fertilizers except marl, salt and plaster, can any methods of tillage or kinds of crops bring these plains into profitable cultivation for ordinary farming, stock raising, or fruit production?

With what the soil now contains, and what plants may accumulate from the rain and air and return to the soil when plowed under for green manure, and with the aid of the cheap mineral manures so abundant in this State, can we bring these sandy soils into profitable cultivation?

MATTERS HISTORICAL.

For many years I have given thought and study to this problem of the sands, and in lectures and articles called attention to the subject. Many persons have aided and encouraged me in this investigation. The effort has been made in our legislature to establish an experimental station on the plains. When the Hatch bill became a law it was felt that the time had come to take up this subject in a practical way. A Farmers' Institute had been held at Grayling, Crawford Co., in which farming on the plains occupied most of the time and thought of those present. When it was determined to establish an experimental farm on the plains, the State Board of Agriculture fixed upon Grayling as the place because it is in the heart of the jack pine lands, is readily accessible by railway, is near a large deposit of marl, the people take a lively interest in the experimental work, and the Michigan Central railroad offered to donate 80 acres of jack pine land for the experimental farm.

THE EXPERIMENTAL FARM.

The tract of land donated for this purpose is described as the west half of northeast quarter of section seventeen, town twenty-six north, of range three west.

It is characteristically jack pine plains, the timber being mostly Pinus Banksiana or "jack pine," some scattering trees of Norway pine, scarlet oak (dwarf), huckleberry bushes, dwarf cherry, sweet fern, trailing arbutus, and many wild grasses (sedges). The ground is nearly level; the fire has run over most of it at frequent intervals, but the central part less than the north and south ends. The farm, both as to soil and the natural products growing on it, is considered a fair average of the jack pine plains. It nearly touches the railroad at the southwest corner, and the experimental field of twenty acres at the south end of the farm is plainly visible from the car windows. The experimental field of twenty acres at the north end of the farm adjoins the village of Grayling. This field is nearly ready for seeding.

FENCING.

The entire farm is surrounded by a substantial board and barbed wire fence to exclude cattle. The fence is placed in the center of a ten foot strip of plowed ground to prevent the spreading of fire from outside sources to the farm. The central forty acres is left substantially in original forest to test the effects of excluding stock and preventing fires.

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Scale of inches.

Experimental Crops raised on the Jack Pine lands at Grayling, Crawford Co., Michigan.

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THE SOUTH EXPERIMENTAL FIELD.

April 19, 1888, contracts were let for clearing and grubbing twenty acres on the south end of the farm, everything to be removed that would be in the way of the plow; also to plow the field in a substantial manner to the depth of seven inches. After the ground was plowed it was harrowed with a spring tooth sulky harrow, then rolled with a heavy roller, then again harrowed, the roots and trash raked into windrows with a spring tooth sulky horse rake, which did the work very rapidly and satisfactorily. After burning the roots the process of rolling, dragging and root raking was repeated till the ground was thoroughly subdued and compacted. This mechanical treatment of the soil was considered very important from the conviction that the loose and porous condition of this soil is often the cause of failure in crops.

On the last day of May and first of June the field was seeded by means of a Disc Roller Drill. Twenty plots of one acre each were separately seeded. The plats run north and south in the field, being nearly four rods wide and a little more than forty rods long.

The following diagram presents the position of the various plots, the kind of seed used and the fertilizer applied:

Experimental field at Grayling—the south 20 acres of the jack pine farm, seeded May 31 and June 1, 1888—the seeds and manures as indicated on diagram.

N.

Spurry.	Alfalfa.	Mammoth Clover.	Red Clover.	Alsike Clover	Hungarian Grass.	Vetch.	White Mustard.	Field Peas.	Rye.	Buckwheat.	Timothy.	Yellow Lupins.	Hungarian Grass.	Ky. Blue Grass.	Orchard Grass.	Tall Fescue.	Perennial rye grass	Meadow Fescue.	Meadow Foxtail.
								No	ma	nur	e.								
						Sal	t	200	lbs.	to	th	e a	cre.						
			Pl	ast	er	200	lbs.	an	d s	alt	200	lbs.	to	th	e a	cre.			
						Pl	ast	er	200	lbs.	to	th	e a	cre.					
					La	ke	Ma	rl 6	to	ns	to	the	ac	re.					

W. E.

S.

It should be noted that a narrow strip of one acre in the northwest corner was planted to experimental trees by Prof. Beal.

MANURES APPLIED.

The field was divided across the plots into five nearly equal zones for testing the influence on all the plants used of certain manurial matters. The south zone was treated with marl from a lake near by, using six tons to the acre, which was incorporated with the soil by harrowing and rolling. To the next zone plaster was applied at the rate of 200 pounds to the acre; to the next zone 200 pounds of plaster and 200 pounds of common salt; to the fourth

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zone 200 pounds of salt, and the last zone received no manure, for purpose of comparison. It will thus be seen that there are one hundred separate experimental plots of one-fifth of an acre each in this field.

After the seeding the roller was again passed over the whole field. I regret that a heavier roller was not used.

On the east side of this field near the fence a narrow strip was sowed and planted to quack grass.

THE NORTH FIELD.

At the north end of the farm twenty acres have been cleared, grubbed, plowed and subdued in the same way as the south field, and is now nearly ready for sowing. Marl will be appled to a part of this field, and plaster on many of the plots. Some seeds not used in the south field will be sowed on the north field, so that the number of plants used experimentally will be about thirty.

THE VILLAGE FIELD.

The ground on the experimental farm is all "new breaking." It is probable that land longer under cultivation and more thoroughly subdued may give different results with some or all the plants used in these experiments. For this reason a field of eight acres in the outskirts of the village was rented of Mr. Brink for experimental uses. This field had been under cultivation for three or four years, and the roots and trash well worked out of the soil. The field was plowed and fitted for crops and seeded the 17th of May, the following seeds being placed in plots, beginning at the west end of the field and passing eastward: Timothy, Alsike Clover, Hungarian Grass, Blue Lupins, Yellow Lupins, Cow Peas, Field Peas, Vetch, Yellow Branching Sorghum, Sorghum and Kentucky Blue Grass, Kentucky Blue Grass, White Mustard, Millet, Tall Fescue, Rye Grass, Red Clover, Alfalfa, White Clover Spurry and Rye. To these will be added seven-leaved Turnip and New Zealand Spinach.

THE CLIMATE.

Climatic conditions limit the field of experimentation at Grayling, and many plants that promise good results must be omitted on account of frost. The Cow Pea, for example, that was sowed May 17, gave promise of good results, but the frost of June 1 was very severe on this plant. It seems that we can not depend upon the use of plants that are easily cut by the frost. A hardy, quick-growing plant that will at the same time accumulate a large amount of vegetable matter is especially needed for that locality.

In order to determine some of the agricultural-climatic conditions, a set of soil thermometers to show the temperature in the soil at distances of 24 inches, 12 inches, 9 inches, 6 inches and 3 inches below the surface of the soil, have been placed in position near the *village field* in charge of Mrs. Brink, who will take observations on soil temperature three times a day for the four months from June to September. A corresponding set of soil thermometers are in position at the College, and a comparison of soil temperatures at corresponding depths at Grayling and Agricultural College may develop facts of interest and value.

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The chemical composition of the soil of the jack-pine plains is of interest in studying this problem. The average composition of six soils taken from different points in Crawford and Iosco counties, in which analysis shows a close similarity of composition, is exhibited in the following table:

Sand and silicates insoluble in acids	94 22
Oxide of iron	1.88
Lime	.37
Magnesia	.06
Potash	.85
Soda	.27
Sulphuric acid	·01
Phosphoric acid	.08
Organic matter	2.16
	100.

Capacity to hold water by capillarity ..... 33 per cent.

The depth of the water line below the surface at Grayling is from 15 to 18 feet.

This preliminary bulletin is issued for the information of the public in regard to the nature and scope of the experimental work at Grayling in the Department of Chemistry. It is only begun, and it is too soon to ask "What shall the harvest be?"

R. C. KEDZIE,
Chemist of Experiment Station.

AGRICULTURAL COLLEGE,
June 16, 1888.

NO. 38.—FARM DEPARTMENT.

EXPERIMENTS WITH WHEAT.

The wheats were sown in field No. 9. The soil is a heavy clay loam, fairly well drained and protected on the east by a belt of timber. The field was an oat stubble which was plowed the middle of August and thoroughly prepared for the wheat. Preceding the oats were two crops of corn. The field had received a heavy dressing of barnyard manure prior to the planting of the second crop of corn. The conditions for all the varieties were as nearly alike as possible. The Clawson may have had a slight advantage in being sown in a plat that sloped a trifle to the north and so was slightly protected from the severe southwest winds.

The plats were sown from east to west, beginning at the south side of the field with the Phelps wheat.

The accompanying diagram shows the area of each plat, the position of the different varieties, the amount of seed and date of sowing.

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DIAGRAM OF FIELD NO. 9.

Phelps, 1 acre, Sown September 21, 1¼ bushels seed.	A.
Surprise, 1 acre, Sown September 21, 1¼ bushels seed.	B.
Diehl Mediterranean, 4 acres. Sown September 21, 5 bushels seed.	C.
Rodgers' Amber, 4 acres. Sown September 22, 6 bushels seed.	D.
Martin's Amber, 4 acres. Sown September 23, 6 bushels seed.	E.
Champion Amber, 5 acres, Sown September 23, 7 bushels seed.	F.
Clawson, 1 acre, Sown September 24, 2 bushels seed.	G No. 3.
Clawson, 1 acre, Sown September 24, 1¼ bushels seed.	G No. 2.
Clawson, 1 acre, sown September 24, 1¼ bushels seed.	G No. 1.

The following notes are from observations made from seed time to harvest:

None of the varieties made a strong, vigorous growth in the fall. At the beginning of winter none of them had much top. This was due largely to the protracted dry weather after seeding.

March 14. All of the varieties are badly winter-killed. The wheat on the eastern slope is most injured by the winter, but the roots are alive, and with favorable weather will make a fair growth.

April 20. The cold winds from March 15 to April 15 were very severe on the wheats, which were badly injured during the winter.

The remainder of the notes will be grouped under the variety to which they refer.

CLAWSON—PLAT G.

June 18. No. 1. Wheat stands 3¼ feet high, but is not thick on the ground; is good color and well headed.

No. 2. This is thicker on the ground than No. 1, but will not average as good length of straw or head.

No. 3. The stand is this plat is better, but the straw and heads are shorter.

June 22. Some heads blasted in No. 3.

July 2. No. 2. Heads well filled, wheat beginning to turn.

No. 3. Straw riper, heads darker than No. 2.

July 11. No. 1. Ripening, average height, 42 in. Although the straw is large and strong, some of the stalks are broken and the heads lie on the ground. Long, large, well filled heads. Plump berries.

No. 2. Straw nearly ripe and tougher than No. 1. Average height, 40 in. Berries not hardened.

No. 3. Straw tough, strong and ripe. Average height, 40 in., short in some places. Well filled heads. Berries turning.

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CHAMPION AMBER.—PLAT F.

June 18. The straw is heavy and very dark green. Average height, 3 ft. Heads short, but plump.
June 22. Uneven on low ground. Heads 2½ to 3 in. long.
July 2. Beginning to ripen.
July 11. Thin in spots. Average height, 38 in. Beardless heads well filled with plump berries just in the milk. Not as ripe as the Clawson.

MARTIN'S AMBER.—PLAT E.

June 18. Height about the same as Champion Amber, but is not as early. Is lighter colored than Champion Amber. The heads are long and slim.
June 22. Good, even stand and good color.
July 2. Heads not quite filled. Kernels not full size.
July 11. Tough, strong straw, still green. Average height, 45 in. Heads well filled, with shorter berry than other varieties. Some kernels still undeveloped.

RODGERS' AMBER.—PLAT D.

June 18. Stands a little higher than Martin's Amber. Thin and bearded.
June 22. Even growth, good color.
July 2. Tinged with yellow. Heads better filled than Martin's Amber.
July 11. About as ripe as Martin's Amber. Average height, 44 in. Heads well filled with berries still in the milk.

DIEHL MEDITERRANEAN.—PLAT C.

June 18. 3½ feet high. Good stand and fine straw. The heads are short and plump. On the whole it looks better than any other plat.
June 22. Darker in color than Rodger's Amber, but not as even.
July 2. Riper than Clawson.
July 11. Average height, 42 in. Heads well filled with berries still in the milk.

SURPRISE.—PLAT B.

June 18. Is about the same height as Diehl Mediterranean. The straw is fine, heads short, plump and beardless, some are blasted.
June 22. Is even, over 4 ft. high, heads 2 to 3 inches long.
July 11. Somewhat uneven. Straw not much changed in color. Heads well filled with berries in the milk.

PHELPS.—PLAT A.

June 18. Does not stand even. Is about 3 ft. high, rather coarse straw. Short heads, some of which are blasted.
June 22. Lighter colored than Surprise, heads 2 to 3 inches long.
July 2. Well filled heads, with full sized berries about the color of the Diehl Mediterranean.
July 11. Thin, straw tough and still green. Height about 45 inches.
The Clawson, Phelps and Surprise were cut July 17. Diehl Mediterranean

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and Rodgers' Amber July 18. Martin's Amber and Champion Amber Ju y 19. There were many short heads and much short straw. The growth of the wheat most severely injured by the winter.

YIELD.

The wheats were threshed July 31 and August 1, giving the following yields:

Variety.	Area. Acres.	Seed. Bushels.	Crop. Bushels.	Per Acre Bushels.
Clawson	1	2	27	27
"	1	1½	24½	24½
"	1	1¼	28	28
Champion Amber	5	.....	104½	20 9-10
Martin's Amber with salt	2	.....	38	19
" " without salt	2	.....	41	20½
Rodger's "	4	.....	69	17¼
Diehl Mediterranean	4	.....	80	20
Surprise	1	.....	15½	15½
Phelps	1	.....	17	17
Mixed wheat	.....	.....	17½	.....
Total	22	.....	462	21

The quality of the Clawson wheat is fair compared with previous years, and good compared with the other varieties grown this season. All of the varieties were slightly affected with rust.

The grain of the Champion Amber, Rodgers' Amber, Phelps and Surprise is not plump.

Martin's Amber and Diehl Mediterranean are somewhat shrunken, but of fair quality.

Salt was applied to two acres of Martin's Amber, April 27, at the rate of 150 lbs. per acre. There was no perceptible difference in the one with salt and the one without, either in growth or date of ripening, but in the yield there was a difference of three bushels, or 1½ bushels per acre, in favor of the plat where no salt was used.

In sowing different amounts of seed, the smallest amount of seed, 1¼ bushels per acre, gives the largest yield, and the largest amount of seed, 2 bushels per acre, the next largest; while the one between, 1½ bushels seed per acre, gives the least yield. I still incline to the opinion previously expressed, that ordinarily 1¼ bushels seed will give the best returns.

It will be seen that the Champion Amber which has for some years been one of our best yielding varieties, falls below the Clawson, while maintaining its place in comparison with all the other varieties.

This old, well known variety, the Clawson, seems to retain, in good degree, those qualities which have made it popular for a longer term of years than most of our varieties.

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The Ambers seem to have been more injured by the peculiar season and the yields are less in comparison than in former years.

The Diehl Mediterranean is of fair quality and yield for the season and warrants farther trial. We have reports from parties who purchased seed of this variety of us a year ago of a yield of 36 bushels per acre.

The Surprise has never yielded well for us and I think after three years of trial, may be labeled as wanting.

The Phelps was sent to us by Mr. J. T. Phelps of Thornville, Lapeer Co., who wrote me as follows: "I found two heads of it in the year 1881 in a field of Clawson on my farm, and sowed the grains from them, 93 in number. I sold 200 bushels last year, 1886. It seems to be a very hardy wheat, and a good yielder. It is a white, bald wheat, and very flinty." Although it was less exposed than some of the other varieties, it falls below them in yield. We shall, however, give it further trial.

The wheats were all sown with the Beckwith roller drill.

It has seemed to me that more satisfactory results will be secured by the testing of a few promising varieties, in not less than acre plats, and in field culture, than by multiplying varieties on small plats, and trusting to the uncertainty of estimated yields from them.

In conclusion, I think the experience of wheat growers generally will commend this rule: "Try new varieties of wheat sparingly, until convinced by repeated tests that they are adapted to your soil and latitude."

EXPERIMENTS WITH PLASTER, ASHES AND SALT, AS A TOP DRESSING FOR MEADOW AND PASTURE LANDS.

Four one-acre plats were staked off in the experimental field No. 5 for the purpose of making some comparisons of the values of such common fertilizers as agricultural salt, land plaster, unleached wood ashes, and a mixture of the three.

One-half of each acre received an application of fertilizers April 24, and the other half June 5.

Adjacent plats of the same size were not fertilized, but every other condition was the same.

The accompanying diagram shows the arrangement of the plats fertilized, the amount used, and when applied.

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DIAGRAM OF PLATS WHERE FERTILIZERS WERE APPLIED.

A.	C.	E.	G.
½ acre. 150 lbs. Salt. Applied April 24.	½ acre. 50 lbs. Plaster. Applied April 24.	½ acre. 150 lbs. Ashes. Applied April 24.	½ acre. 125 lbs. Mixture. Applied April 24. 50 lbs. Salt. 50 lbs. Ashes. 25 lbs. Plaster.
½ acre. 150 lbs. Salt. Applied June 5.	½ acre. 50 lbs. Plaster. Applied June 5.	½ acre. 150 lbs. Ashes. Applied June 5.	½ acre. 125 lbs. Mixture. Applied June 5. 50 lbs. Salt. 50 lbs. Ashes. 25 lbs. Plaster.
B.	D.	F.	H.

The meadow upon which the fertilizers were sown was seeded last year with timothy and clover.

There were spots in each of the plats where the clover was thin, it having been injured by the severe weather of last winter.

The plats will be referred to by the letters used in the diagram.

Early in the season the clover seemed to be of a darker color in plats C and G than in A and E; this was, however, less noticeable later.

Both clover and timothy made a good growth in all the plats upon which the fertilizers were sown. During the entire growing season there was an appreciable difference in favor of the fertilized plats, both in color and growth, over those that received no application.

The grass in the twelve plats was cut July 5. The hay from plats B, D, F and H was drawn into the barn July 6, and that from plats A, C, E and G, and from those plats that received no application of fertilizers, July 7.

The hay from each plat was kept separate, and weighed accurately in so nearly as possible the same condition of dryness.

The following tables give the yield from each plat, and the totals and gain per acre from use of these manures:

Plat A,	150 lbs.	Salt,	yield,	2120 lbs.	Hay
" C,	50 "	Plaster,	"	2240 "	"
" E,	150 "	Ashes,	"	1860 "	"
" G,	125 "	Mixture,	"	1990 "	"
	No Fertilizer,		"	1540 "	"
Plat B,	150 lbs.	Salt,	"	1900 "	"
" D,	50 "	Plaster,	"	1626 "	"
" F,	150 "	Ashes,	"	1730 "	"
" H,	125 "	Mixture,	"	1930 "	"
	No Fertilizer,		"	1560 "	"

TOTAL YIELD FROM ONE ACRE.

A and B, Salt	yield,	4020 "	"
C " D, Plaster,	"	3866 "	"
E " F, Ashes,	"	3590 "	"
G " H, Mixture	"	3920 "	"
No Fertilizer,	"	3100 "	"

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300 lbs.	Salt	increases	yield	per	acre,	920	lbs.
100 "	Plaster	"	"	"	"	766	"
300 "	Ashes	"	"	"	"	490	"
250 "	Mixture	"	"	"	"	820	"

PASTURE.

Similar applications were made on plats in pasture field No. 4. This field has received top dressings of barnyard manure for some years, and was in a condition of fertility to give a good crop of grass without any application. The effect of the fertilizer was therefore not so apparent on the pasture as on the meadow. The pasture was of excellent quality June grass and white clover; but these would not be so likely to respond to such applications in increased growth as the red clover and timothy of the meadow.

This pasture has been fed close, and we have only been able to judge of the effect of the applications by the appearance of the several plats.

I incline to the opinion that the plat sown with the mixture was most benefited, that with ashes next, then salt, and plaster last.

The weights from the plats in No. 5 indicate:

1st. That the application of these fertilizers increased the yield from 24 to 30 per cent.

2d. That in this test the gain was in the order of salt, mixture, plaster and ashes.

3d. That applications early in the season give better results than those made later.

SAMUEL JOHNSON,
Agriculturist.

AGRICULTURAL COLLEGE,
August 28, 1888.

NO. 39.—DEPARTMENT OF ZOOLOGY AND ENTOMOLOGY.

EXPERIMENTS WITH INSECTICIDES.

CODLING MOTHS.

For the past eight years I have demonstrated annually the value and safety of London purple, arsenite of lime, as a specific against the codling moth.

This season (1888) I repeated the experiments with three objects in view. First, to ascertain the relative value of spraying once, twice, and three times. Secondly, to study the effects of the mineral on the foliage when used more than once, and thirdly, to note if the quantity of fruit on a tree was important in the results attained. As previously reported, I have several times sprayed the trees only once; just after the blossoms had all fallen, with perfect success; and that when the apples on trees adjacent, not sprayed,

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were seriously injured. Last season, as reported, once spraying was not so effective; yet, still enough so, not only to pay well, but in most instances practically good enough. As we had heavy rains last year, soon after the treatment, I was led to believe that the rains caused the diminished effect.

Again reports came to me of the injurious effects of the poison in blighting the foliage, even though as dilute as one pound to one hundred gallons of water. I hoped that by applying the poison on some trees once, on others twice, and on others three times, I might be able to formulate some rule as to the best practice to secure the best effects with the least damage to foliage.

I also observed last year that where trees had but few apples the proportion of loss was greater than where the tree was well loaded.

This year we sprayed later than common, as the season was several days later than usual. The trees were sprayed June 6th, June 12th and June 20th. On June 9th and 10th there were sharp showers but the weather was cool till the 9th, when the temperature reached 80° F., in the shade, at 2 P. M. The application was made about 2 P. M., on the 6th, when the thermometer stood only 64° F., in the shade. The second application made June 12th, was made at the same time of day, the temperature being 73° F., in the shade. The next day was still warmer and there was a heavy shower. The third application was made June 20th. The thermometer stood at the time, 2 o'clock P. M., at 90° F. On the next day there was a heavy shower.

The results were as follows:

		Per Cent Wormy July 31.	Per Cent Wormy Aug. 31.	Effect on Foliage.	Amount of Fruit.
Sprayed Once..	No. 1, Wagoner.....	10	14	No injury....	Few apples.
	No. 2, Northern Spy.....	4	16	" "	" "
Sprayed Twice.	No. 3, Maiden's Blush.....	3½	2	Slight injury.	Much fruit.
	No. 4, Grimes' Golden.....	9	6	" " .	" "
Sprayed Thrice.	No. 5, Golden Russet.....	3	5	Serious injury	" "
	No. 6, Shiawassee Beauty..	2	7	Some injury..	" "
Not Sprayed....	No. 7, Transcendent Crab..	.....	50	.....	Few apples.
	No. 8, Siberian Crab.....	.....	28	.....	Much fruit.

In some of the trees, those not bearing heavily, every apple was examined, while in those heavily loaded from three to eight hundred apples were cu open, taking in each case the apples clean. In the examination of July 31st we became aware that we were not able to find all the wormy apples, as the season was too early, on such trees as Northern Spy. In this case the apples were not cut open except the work of the insect showed on the outside of the fruit. Two years ago trees 3, 4, 5 and 6 were not sprayed, and bore that year very heavily. That year it was difficult to secure enough good fruit to show at the fairs. This year, as will be seen, nearly all were free from attack. Even in case of the trees sprayed only once and that followed by a brisk shower, the loss was only fourteen (14) and sixteen (16) per cent. As the wormy apples usually fall prematurely, these will be eaten by swine kept in the orchard, and nearly every apple at time of harvest will be fair and sound.

In case heavy rains occur soon after spraying, more fruit will be saved by a second spraying. I doubt if it will generally pay to spray a third time, even if heavy rains occur. As will be seen there was no injury to foliage at all from a single spraying, while a second and third spraying did some

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injury and in one case where the tree was sprayed three times the injury to the foliage and to the tree was quite serious. In spraying cherry trees, as will be seen in the sequel, the same injury from a second and third application was observed.

This year, as last, it was noticed that the percentage of loss, both with trees sprayed and with those not sprayed, was greater with trees which bore but few apples. Trees one (1), two (2) and seven (7) show this decidedly. Of course, with fewer apples each apple will be more apt to receive an egg, and so, many more proportionally, of apples not poisoned, either from neglect to spray, or from lack of thoroughness, will be injured. If every apple received the poison it would make no difference in case trees were sprayed; but it will rarely happen in practice that every apple will receive the poison, and so trees with few apples will suffer proportionally most.

CONCLUSIONS.

It is more and more patent that it pays remarkably well to spray our apple trees. It is, if not the only way, certainly by far the cheapest and most practical way that we can conquer this terrible apple pest and secure nice, sound marketable apples.

(2.) *We should never spray until the blossoms fall from the trees.* To spray earlier endangers the bees, and the honey they gather, and is too early to give the best results. *Too early,* first, because it is not needed till the blossoms fall, and the earlier it is scattered the sooner it will disappear, or lose its effect; and second, because the longer the poison is on the trees the more likely it is that it will be washed off by heavy rains. We should, however, spray as soon as the blossoms have all fallen from the trees. At this date no possible harm can come to bees or honey; to wait longer, is to wait so long that some of the larvæ will already have entered the fruit, and be safe from the poison. I think we shall be in time if we wait till the blossoms have fallen, even from such trees as Northern Spy, where the blossoms are slow to appear and so, late to fall. In case there is no heavy rain, this one application will be enough. In case there is a heavy rain, especially if the trees are bearing sparingly, it will often pay well to spray a second time, two weeks after the first.

STRENGTH OF THE MIXTURE.

The proportion of the mineral (London purple or arsenite of lime, as I have proved some years since, is the best) to the water is important. One (1) pound to one hundred (100) gallons of water is abundantly strong. And as even this strength is sometimes injurious to the foliage, especially if applied so thoroughly as to insure contact with each apple, we should never use a stronger mixture. Even three fourths of a pound to one hundred (100) gallons will often prove more satisfactory than a stronger mixture, especially so if two applications are to be made. The second application should never be stronger than one pound to one hundred and fifty gallons of water.

PUMPS, ETC.

As spraying with insecticides is becoming so exceedingly profitable, every person with few or many fruit trees will desire to know of and to secure the best pump.

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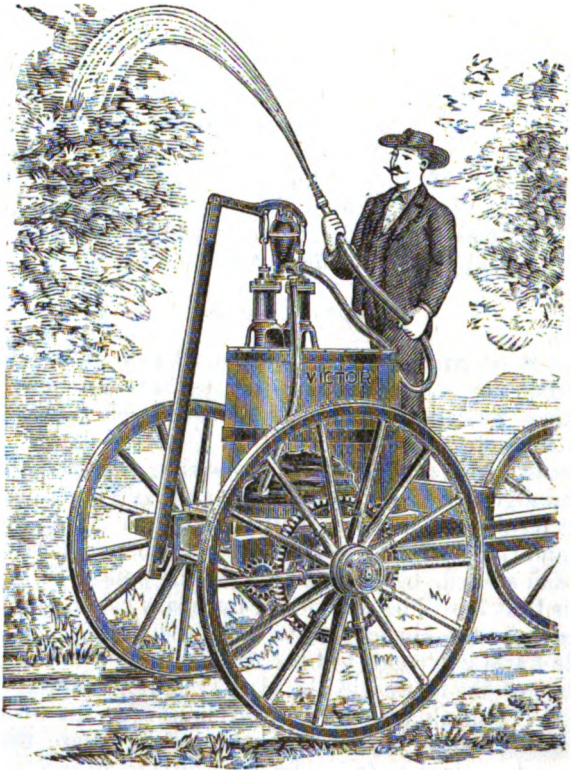
For a large orchard, I know of no pump comparable with the Victor Field Force Pump (Fig. 1).



[Fig. 1.]

This runs with gearing attached to the hind wheels of any common wagon; so the force that draws the wagon does the pumping at the same time. The pump is double acting, and by driving the horses at a rapid walk the liquid is thrown with great force and so is thoroughly scattered, and is very likely to reach the calyx of every apple. A second pipe discharges into the barrel with great force, and so the poison is kept stirred. The pump works so easily, the horses work it, that a lazy man is liable to do good work, even if the wind blows, and he has to go on all four sides of each tree. In truth it is fun to simply drive and man the hose. I think it will often pay for four or five neighboring farmers to unite and buy this pump at $30, its cost, rather than for each to buy a cheaper one. One farmer might buy this pump, and then spray all the orchards in the neighborhood. His neighbors could well afford to secure his services, and doubtless would generally be very glad to do so. I urge this pump, for it is natural for the average man to do more thorough work when the work is easy.

This same company, Field Force Pump Company, Lockport, New York, also makes a fine hand pump, the Perfection (Fig. 2), as does also the Gould

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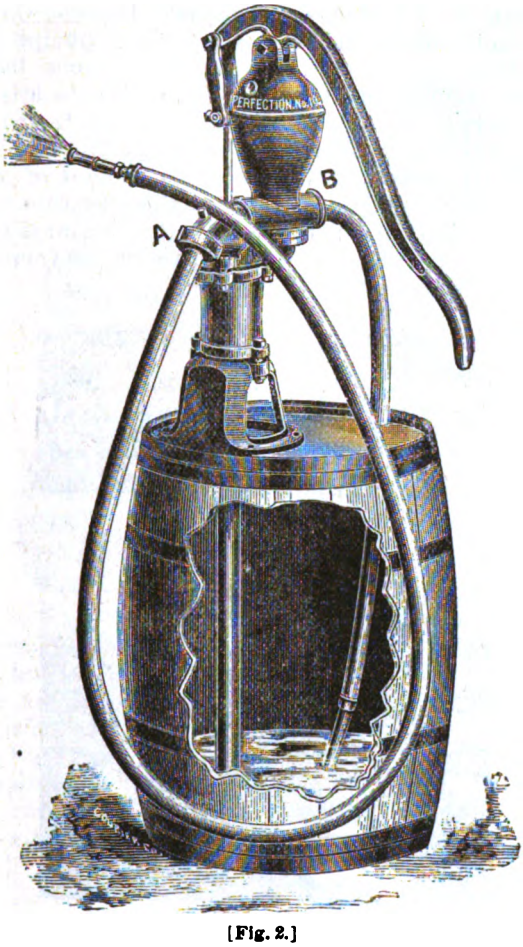
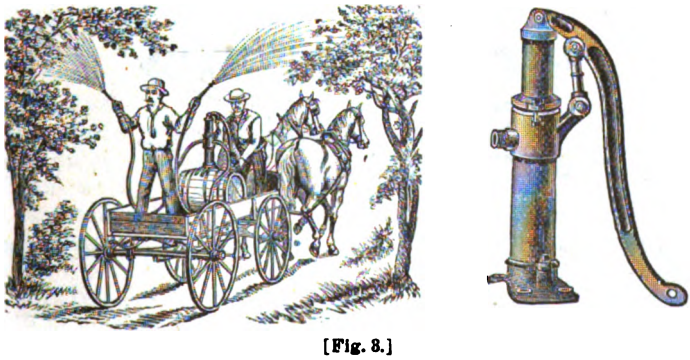


[Fig. 2.]

Manufacturing Company, Seneca Falls, N. Y. (Fig. 3). The former sells for



[Fig. 3.]

$12.00, while the latter, which is double acting, sells for from $14.00 to $16.00 according to the size. I have used both these pumps, and can recommend

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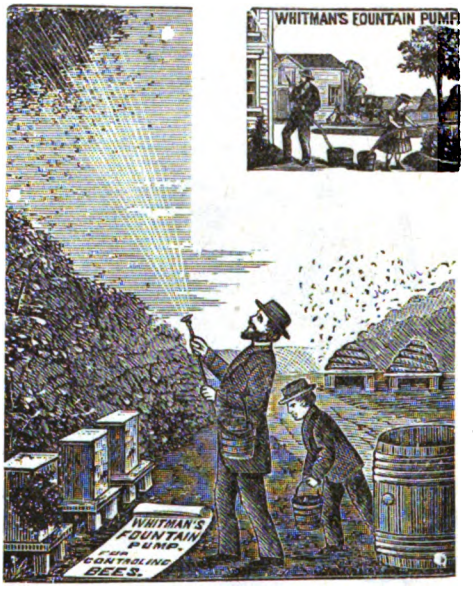
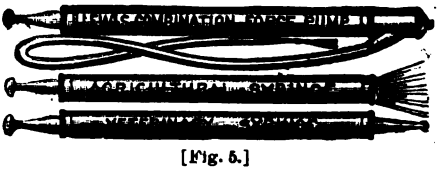
them. The Nixon Nozzle Machine Company, Dayton, Ohio, sell a pump which works well, for about $11.00. All of these pumps can be attached to a barrel or tank. It is very important that none but clean barrels be used. I have known great loss and vexation to arise from the use of an oil barrel where some scum or refuse passed into the pump and clogged the valves. It is also important that the poison by thoroughly mixed. This is best done by mixing thoroughly in a small amount of water first, then mixing this in the barrel or tank. Unless the pump keeps the mixture well stirred, as the first two pumps mentioned do, then we must see to it that this is secured. There is no better way than to pump quite frequently back into the barrel or tank holding the liquid.



[Fig. 4.]

For a few trees, the Whitman Fountain pump, (Fig. 4) J. A. Whitman, Providence, R. I., or the Lewis Pump, P. C. Lewis, Catskill, N. Y., are good.



[Fig. 5.]

These are excellent for many other purposes and cost, the former, $7.00. The latter costs only $6.00.

SPRAYING NOZZLES.

It is also important to have good nozzles. These should finely divide the spray without breaking its force. The Cyclone nozzle fails just here. It

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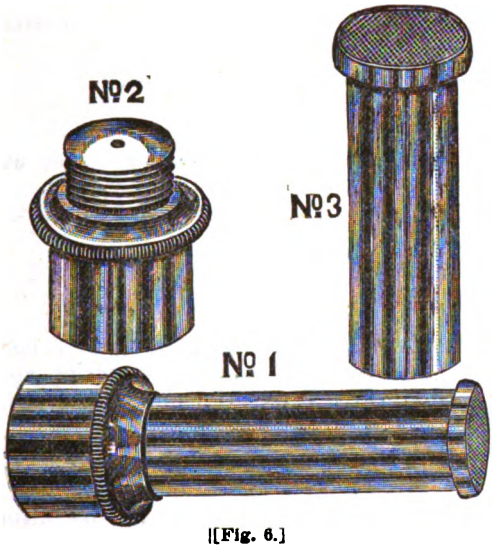
makes a most beautiful spray but it so breaks the force that the liquid does not scatter as it should, and so it fails of satisfactory execution.



[Fig. 6.]

The Nixon nozzle (Fig. 6) throws a fine spray with great force. It is an excellent nozzle, but is not adjustable, so if we wish to change the quantity, we must change nozzles. The "Boss nozzle" sold with the Field Force pump, is not satisfactory; but another nozzle sold by them, the "Graduating Spray nozzle" (Fig. 2), works well and can be made to throw much or little, and also maintain the force. This and the first pump mentioned make a most excellent combination. The Gould Co. also send a very simple and excellent nozzle with their pump.

THE PLUM CURCULIO.

It will be remembered that I have used the London purple several years with quite indifferent success, to keep at bay the curculio. The fact that some fruit growers reported excellent success with this remedy led me to conclude that possibly I had not been persistent and thorough enough in this warfare. The curculio commences to work anywhere on the plum, which has a smooth surface everywhere, while the codling moth lays it egg right in the cup or funnel like calyx end of the apple. Thus the wind and rain would free the plum of cherry or general surface of the apple of the poison, much more readily and quickly than they would the rough cavity of the calyx end of the apple. Thus we can understand, how, granting, that the arsenites are alike effective against codling moth and curculio, that more care would be required in resisting the attack of the latter. This season we arranged our experiments with this point directly in view.

June 4th, the trees, both plum and cherry, were jarred and curculios were caught. The mark of the curculio was also found on both cherries and plums.

The trees were sprayed June 6th, June 12th, and June 20th. The material was the same as that used in spraying the apples, viz: one pound London purple to one hundred gallons of water.

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Careful examination June 12th, found no stung cherries and very few plums. June 26th, 250 cherries were picked from the sprayed trees, and not one was injured. The crop of cherries was large, and no cherries from the sprayed trees were wormy. July 16th and 18th, the following plums were all gathered under the trees and cut open:

Tree 1 there were 16 plums, 10 wormy.
Tree 2 (Wild Goose) 117 plums, 23 wormy.
Tree 3 (Washington) 33 plums, 3 wormy.

Close examination found no stung plums on the trees, and the crop upon picking was very free from injury.

Cherry and apple trees near by not sprayed, suffered seriously.

CONCLUSIONS.

From these experiments, and those of former years, I conclude that while one application will not save our plums and cherries, and prevent apples from being stung, two or three applications may be of signal advantage.

INJURY TO FOLIAGE.

It remains to be stated that while the foliage on the plum was not injured by the three applications, that on the cherry was much blighted. After the first there was no apparent injury, after the second the injury was obvious, after the third quite serious. Hereafter I shall use a weaker preparation for the second and third spraying. About one pound of the London purple to one hundred and fifty gallons the second time, and the same to two hundred gallons the third time. If, as the experiments of Prof. C. M. Weed of the Ohio Experimental Station show, lime water will accomplish this object as well, then it should be used in lieu of the arsenite, as it does no harm, I think, to the foliage, and it were better not to use poisons unless we must.

It will be remembered that there were rains after each application, but the weather was much warmer at the time of the second and third application. Whether the rains or the temperature have any effect to increase the injury to the foliage I am unable to say. Dr. C. V. Riley expresses the belief that both may do so.

CARBOLIC ACID WITH LIME AND PLASTER FOR THE CURCULIO.

For the past two or three years, Mr. J. N. Stearns of Kalamazoo, Michigan, has treated some of his trees with common air slaked lime to which he added some crude carbolic acid. This was thrown on to the trees just as the calyx was falling from the fruit, or just as the curculios were commencing to lay eggs. Trees thus treated bore good crops, while others not treated, bore no plums at all.

The past season I tried the same kind of experiments. I used both air-slaked lime and plaster, using one pint of strong crude acid to one hundred pounds of the minerals. I much prefer the plaster to the lime, as it is much more pleasant to mix the plaster and more agreeable to throw it on to the trees. The lime is so light that it flies badly, while there is far less trouble in use of plaster.

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The trees were treated June 5th, and again a week later. The dust was thrown on by going up on a tall step-ladder. It was easily and quickly done. We treated both plum and cherry trees. The application did no harm to the trees so far as could be discerned.

On July 16th and 18th, careful examination of upwards of 250 cherries from each tree did not find but one larva in the whole lot examined. Pickers said that there was no wormy fruit at harvest.

The plums that fell from the trees were picked up and examined, and only one was stung. The fruit was very fair, and entirely free from worms when gathered.

This seems a very excellent method to secure plums and cherries free from attack by the curculio. While some might object to the arsenites, no one could object to this method. On pears and apples, while this would probably secure against attack from curculios, it would not, I think, keep the codling moth at bay, though I shall carefully try it next year. I have used lime and plaster alone with no success. I hardly think the result would be different with the carbolic acid added. If not, we should have to use the arsenites for the moth, and so that would do for all. While I have tried this remedy for only one year, I believe it safe to recommend it, especially in view of Mr. Stearns' success. I shall try it again more extensively next year.

CARBOLIC ACID AND PLASTER FOR OTHER INSECTS.

From our success with the above preparation, I hoped to find it valuable to destroy other insects. Circumstances forbade a trial except to combat the small striped squash beetles (Diabrotica vittata) and the black (Epicauta Pennsylvanica) and ash gray (Epicauta cinerea) blister beetles. A thorough trial gave no satisfaction whatever. We also tried the same preparation about cabbages to prevent attack from the cabbage maggots, Anthomyia brassicæ. None of the cabbages were attacked, but the slaking or setting of the plaster about the plants was a serious injury to some of the plants. While I believe that this mixture might tend to prevent attack from the anthomyians, I do not think its use for this purpose advisable, unless a piece of stiff paper be first wound close about the stem of the plant.

THE ANTHOMYIANS.

I am more and more convinced that the insects of the genus Anthomyia, working on onions, cabbages and radishes are one and the same species. This year beans have been seriously injured again by a similar, I believe the same species. There is cumulative evidence that by planting the favorite food plant, probably the radish, among the other plants, especially among onions, the latter may be, if not entirely, at least practically saved. I believe these plants are relished about in this order by these insects: radishes, cabbages, onions, beans; then soft canes of raspberry, etc. The best way to raise radishes is either to put them in cold frames and then keep them covered, after the insects appear, with cheese cloth, or else change the position of the beds as recommended for cabbages. For cabbages, unless we can preserve them from attack by alternate rows of radishes, the way to avoid the attack is a change of position annually, often less frequently of the area planted. A removal of the bed for a half mile is usually sufficient,

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especially if there are favorable plants hard by to prevent the insects from wandering off.

PYRETHRUM OR BUHACH.

California pyrethrum or buhach, still holds its own as a specific against the cabbage caterpillar. There is no better remedy. Mr. E. S. Carman reports as the result of some years' experience, that this same buhach is a specific against that serious pest of the orchardist, the rose chafer, Macrodactylus subspinosa. We had no opportunity to test the value of this insecticide upon this beetle, but did try it on the blister beetles with marked success. May it not be that Mr. Carman's success, and the want of success which others report, may be harmonized in the fact that Mr. Carman was more thorough and persistent in his work. It must be remembered that buhach is effective because of a volatile substance which is quick to escape, if the powder is left exposed. Hence, unlike the arsenites, it must be applied daily. An application to-day, while it will kill the insects at work, may not do so to-morrow. Thus frequent applications only can give success.

DESTRUCTION OF ANTS.

I often hear complaint of ants. In the south, these insects enter beehives, it is said, and greatly annoy the bees; killing many of the workers, and sometimes the queen. In the north, ants sometimes enter houses, attracted by various articles of food, and become a serious disturbance. The chief complaint, however, comes from those who are annoyed by ants on the lawn. It is a luxury to lie on a beautiful grass-plat, but this delight is greatly tempered, if the one enjoying it becomes the parade ground of hungry ants, and ever and anon feels their sharp jaws.

Some years since, I succeeded admirably in poisoning ants which had collected in the supers of my bee hives, probably for warmth, by feeding them a syrup in which a little Paris green had been mixed. The box in which the poison was placed was securely closed by means of a wire gauze cover, so that by no possible means could the bees gain access to the poison. The past summer I tried to kill ants on our lawns in the same way, but without success. Either they did not like the poison, or else did not eat enough to destroy them. They seemed to eat it some, but I could not see that their ranks were perceptibly thinned.

BISULPHIDE OF CARBON FOR ANTS.

I also tried bisulphide of carbon, and with marked success. To use this, we have to find the ant hills, or mounds which harbor the ants. This is rarely ever difficult. We now use a crowbar, with which we make a hole in the centre of the mound which should reach down to the level of the lowest gallery of this ants' nest. We now turn in about a half a gill of bisulphide of carbon, after which we throw on immediately a shovelful of clay, which should be at once compactly trodden down. This holds the liquid in the nest, and its very volatile nature, together with its poison fumes, soon destroys the last ant of the nest. I have detroyed a nest utterly with one application. Sometimes the remedy would have to be repeated, to become perfectly effective.

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TREE PLANTING.

It was a happy thought and wise legislation on the part of our law makers: the enactment of the provision establishing Arbor Day, and making it the duty of our Executive to proclaim each year that a certain day shall be observed for tree planting. Each year the attention of our people is thus called to this important matter. and as a result we may expect soon to see our bleak, barren school yards replaced by grounds with cool, refreshing shade. Our roadsides are already becoming beautiful with graceful trees, and grateful with shade. More and more rare are the farm houses bleak in the absence of bush or tree. Thus by this enactment, and the consequent arousing of interest and attention. our rural districts are not only becoming more beautiful, but the farms in them are becoming yearly intrinsically more valuable. It is now believed by our best scientists that abundant trees temper the blasts of winter, and aid to prevent the extremes of rain and drougth in summer. If so trees serve a double purpose, they beautify, and benefit the country practically, at one and the same time.

TREE PLANTING ON THE INCREASE.

Owing to agitation through the press, legislative action, the Governor's annual proclamation, and the fact that farmers are noting the added beauty given to our rural scenery through the presence of trees, and the further and still more convincing fact that farms thus embellished sell for a considerably enhanced value; influenced by some or all of these reasons, tree planting along our roadsides and private drives, and about our farm houses and grounds has greatly increased for the past few years. Now there are thousands of trees planted each spring where there were tens, ten years ago. This is so emphatically wise that we may hope and expect to see the custom continue, and continue to increase. It can hardly be otherwise, and so any hints that will make such planting more profitable and satisfactory will not be amiss.

THE PRESENT CUSTOM.

At present the hard or sugar maple, *Acer saccharinum*, is set far more abundantly than any other species of tree, deciduous or evergreen. Yes, more abundantly than are all other species put together. The elm is planted to a limited extent, while the lombard poplar, which is about as graceful and as productive of shade as a bean pole, is still set to some extent, though I am happy to believe that this tree is becoming less and less a favorite. It can hardly be otherwise, with a species that has only rapid growth to recommend it.

IS A CHANGE OF CUSTOM DESIRABLE.

It is a lamentable fact, that a large proportion of the maples set out die. I believe I an stating it mildly when I say that not one tree in ten of this species, recently set in our State, survives the first three years succeeding the planting. A still smaller proportion grow to be large trees.

The cause of this is not far to seek. This tree is a favorite with insects as well as with ourselves. About forty insects work in our country to destroy our maples. Of these three species are very common in our State, and are doing very serious and extensive damage; so much so, in truth, that not only are the young newly planted trees dying in great numbers, but the large, more mature trees are succumbing to the same enemies. This is not only true in the country, but possibly even more marked in the city. Thus in Detroit, Jackson, Lansing, in fact all over our State, complaint comes to us, that the

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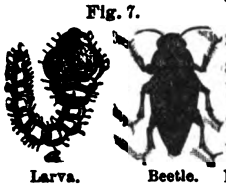
maples are dying. Close observation shows that in nearly, if not all, these dead or enfeebled trees, the borers above referred to are the main and direct cause of the decline in vigor. One of these borers, the big-headed apple-tree borer (*Chrysobothris femorata*), (Fig. 7) which is also a serious enemy of the apple orchard, is far more likely to attack trees of low vitality or lessened vigor, possibly because the blistered and roughened bark affords a safer and more attractive nidus for the eggs. If we may judge from analogy with the pine borers, and in this case it is not very unsafe to do so, we may also conclude that the lessened vigor of the tree renders it more susceptible to attack from the long horned (*Longicorn*) beetles. Reasoning in the same way we should also believe that the aroma from a dying or enfeebled tree, and not the rougher bark merely, was attractive to these insects. When our forests of pine are burnt over, as every lumberman knows, the borers, both buprestids and cerambycids, fairly flock to the trees to complete the destruction. We may well believe, then, that anything that reduces the vigor of our maples tends to encourage the fatal attack of the several boring beetles that essay to destroy these beautiful trees in our State.

Fig. 7.



Larva. Beetle.

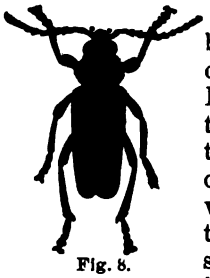


Fig. 8.
Maple Borer.

Thus two of these borers, the beetles Chrysobothris femorata of the family Buprestedæ, and Plagiontus speciosus (Fig. 8) of the family Cerambycidae, while they may and often do work serious damage to vigorous trees, very likely are even more ready to destroy those not up to the standard of vigor. We know this is surely true of the first named. The maple Ægerian Ægeria acerni, (Fig. 9) a beautiful moth of the boring family Ægeriadæ, also helps to destroy even our soundest and most thrifty trees, as I have known them to attack trees apparently in the best possible condition. Two other borers, both very common in Michigan, also attack our maples, and may aid in the destruction. One, the Horn tail, Tremex Columba, (Fig. 10) though very common, I think does less harm as, so far as I have noticed, it attacks for the most part unsound wood. The other, Dicerca divaricata, is also a Buprestid, and its habits and work are doubtless not very unlike the hardly more common Chrysobothris femorata. It also works on cherry trees.

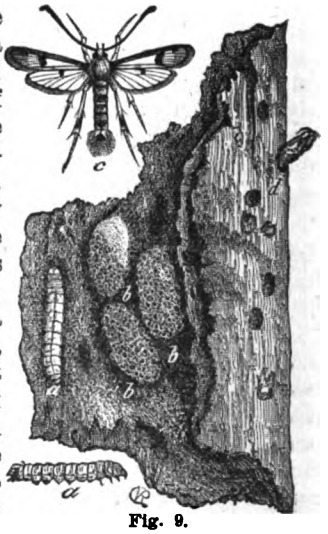


Fig. 9.
Maple Ægerian.

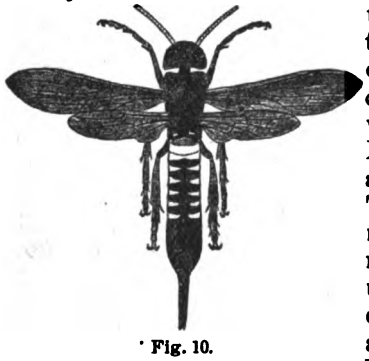


Fig. 10.
Horn Tail.

Fig. 11.
Cherry Tree Borer.

Three other insects, which attack the maple are so common in Michigan as to deserve attention, the last of which is often very harmful to the trees:

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The maple Anisota (*Anisota rubicanda*) is a beautiful moth (Fig. 12, c female). The moth is nearly white, with a rose colored area more or less marked on the anterior wings. The caterpillar (Fig. 12, a) is striped dark green, and light yellowish green, and has black spines, as shown in the figure. Like all bombycids or silk moth larvæ it has sixteen legs; but unlike them it and others of the same genus pupate in the earth. Figure 12 b shows the pupa or chrysalis. London purple thrown on to the foliags as already explained would surely destroy these insects should they ever become numerous enough to cause anxiety.

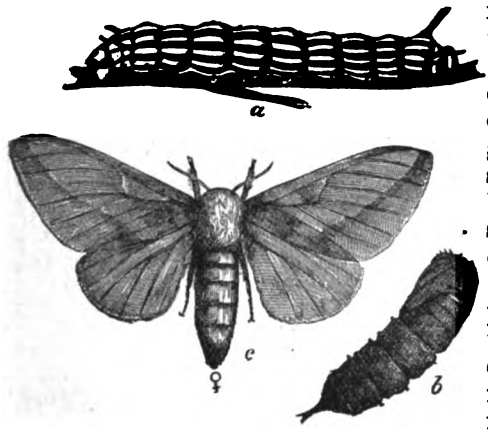

Fig. 12.—a larva. b pupa. c moth.

The nearly related oak caterpillars which were as numerous and destructive to the oaks a few years ago are now, thanks to bird and parasite, rarely seen. The same is, and probably will remain true of this insect.

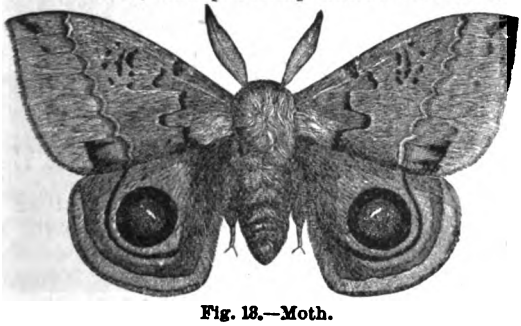

Fig. 13.—Moth.

A still more rare, but a large and beautiful moth is taken here each year. It is the *Hyperchiria io*. (Fig. 13.) It is purplish brown, with dark markings on the body and primary wings, and yellowish marked with black on the posterior of the wings. The large eye-like spots are bluish ringed with black and centred with white. The male is yellow on all the wings and smaller. The larva (Fig. 14) is green, with numerous tufts of spines. It is a very

Fig. 14.—Larva.

beautiful caterpillar. This is one of our few stinging larvae. It stings about

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as does a nettle. This insect works on several other kinds of trees, and can also be destroyed by the use of London purple.

The maple tree bark louse is often so numerous as to seriously injure our sugar maples. This is one of our scale insects.

Fig. 15. Mature Lice.

The mature lice (Fig. 15) as seen on the twigs in June and July are very noticeable because of a mass of cotton-like secretion (Fig. 15) which often lifts the scale entirely free from the twig on which it rests. This fibrous nidus is a good protection for the hundreds of eggs which are entangled in its mass. Soon these eggs hatch

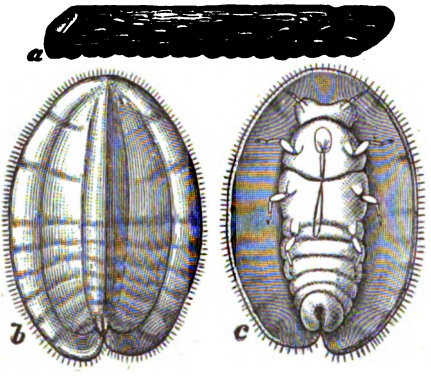

Fig. 16.—a. Partly grown lice on twig. b c. Lice just hatched, dorsal and ventral views. Greatly magnified.

and the young lice (Fig. 16) attach to the leaves—anchored by means of their beaks, which are veritable suction pumps—and commence to pump the sap and life from the foliage. (Fig. 17.) In the fall as the leaves begin to dry up, the young lice still small (Fig. 16, upper cut) migrate from the leaves and attach to the twigs. In spring they begin again to suck the sap from the twigs, grow very fast, secrete or exude a sweet substance which attracts bees and other nectar lovin ; insects, and by June secrete the fibrous substance which is soon to receive the hundreds of eggs. These lice increase so rapidly, that were it not for their bird and insect enemies, they would soon exterminate the maples without aid of borers and caterpillars. The male (Fig. 18) appears in May. It is

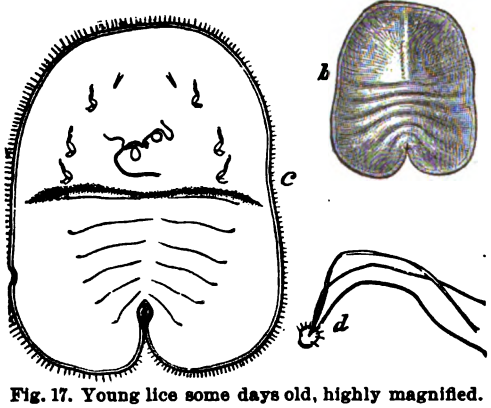

Fig. 17. Young lice some days old, highly magnified.

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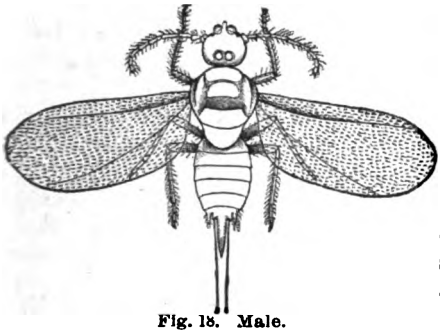

Fig. 18. Male.

possessed of two wings, a curious exception to the insects of this order—Hemiptera.

The kerosene emulsion is a specific against this insect, but its application is expensive, and were it necessary to fight these bark lice to save our trees, this alone would make the planting of maples a doubtful policy. Other scale lice of the genus Lecanium also attack the maples.

HOW TREES ARE SET AND CARED FOR.

It hardly need be said, that tree planting, especially along our streets and roadsides, is done with the most flagrant disregard of the needs and well being of the trees planted. Trees are dug up hastily, often from a root-matted soil of the forest, and thus they are nearly robbed of their roots. Next they are frequently drawn and distributed along the street where they are to be planted, and the roots all exposed, left to wilt and dry up for hours and even days. Then a small hole is dug, often in hard clay drawn from some sub-soil in grading a street, or possibly in some hard clay from which the surface soil has all been removed. Even if the soil is strong and rich, a luxuriant growth of grass is usually left very near the newly planted tree, to snatch the elements from the soil before the young rootlets from the tree can secure them. The roots are now crowded into the meager space, and the earth filled in and the tree left to die, of course. The above is no fancy sketch, for I have seen every phase of it illustrated time and again along the streets of Lansing, and along the highways in various parts of the State. It need hardly be said that very few of such trees live at all, and those which do survive make a sickly show for a time and then follow their less persistent comrades. It is true that in some cases trees are well managed, are skillfully transplanted and cared for, but the general practice illustrates one or more (usually several or all) of the features as described above.

THE REFORM SUGGESTED.

The following suggestions are worthy of adoption, whatever species of trees are to be transplanted. "What is worth doing at all is worth doing well." In transplanting maples, as we have already seen, because of the liability of enfeebled trees to attack from the borers, these suggestions are particularly valuable and worthy of attention.

First, good, vigorous trees with ample, bushy roots and rootlets should be secured. It will often pay to purchase such from a nursery. If secured from the forest, they should be dug so carefully that there shall be no lack of roots and rootlets. In either case, it will often pay to set the trees in some fertile field where they can be cultivated well for one or two years, when they may be transplanted to street or roadside. This course will insure such added vigor that it can hardly fail to give satisfaction. Once dug, the trees should be reset as soon as possible, and never exposed to the

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sun. Such exposure of the roots is almost sure death to evergreens, and very harmful to all trees. If any roots are badly bruised, it is well to cut such off, and at the same time the tops should be heavily pruned, so that the balance between top and roots may not be seriously disturbed.

The hole where the tree is to be set should be large, so the roots can be spread out as they naturally rested in the earth, previous to transplanting. If the soil is hard and barren, good soil should be at hand and should be added liberally about the tree. I have found this not very laborious or expensive. A load of good soil is driven along close beside the holes, and used as needed. The earth is pressed firmly about the roots. After planting, which may be done either in fall or spring, the trees should be still cared for. As soon in spring as the earth is in good condition to work, each tree should be spaded about for two or three feet around the tree, and then well mulched with good coarse manure. This should be spaded under the succeeding spring, and mulch again added. Such labor continued for three or four years will usually pay well, in the added vigor which it secures to the trees. In case the trees are maple, apple, or locust, it is very important that action be taken the first two or three years, to secure against attacks of borers. This should be done in the month of June, about the middle of the month. A cloth should be dipped in soft soap or very strong soap suds, and then used to *thoroughly* rub the trunks of the trees, so that they are *thoroughly* soaped. This will keep the borers off, and should never be neglected the first two or three years after planting the species named above. It would be safer to give this treatment twice; about the 10th of June, and again the very last of the month. If to be applied but once, it will pay to add carbolic acid to the wash as follows: Use one quart of soft soap or one-half pound hard soap, whale oil preferable, to two gallons of water, heat this till it boils, then stir in thoroughly one pint crude carbolic acid. This holds its virtue longer than does the soap alone, and one application about June 10th usually suffices to resist the borers.

All this may seem like too much work and expense. Yet I have tried it and find it is not serious at all. And the healthy vigorous trees say thank you so plainly and unmistakably that I am sure no one will regret the time and labor thus spent. Of course, stock should not have access to lane, street, or road where trees are newly planted, or for some years thereafter. If they are the trees must be so guarded by stakes, etc., that they shall receive no injury. To properly secure against such injury is difficult and expensive.

A VALUABLE SUGGESTION.

But why plant maples and locusts; trees that are so susceptible to injury and ruin? The elm is quite as beautiful, full as vigorous a grower, and almost free from attack by borers among us. Yet there is an objection to the elm. The canker worm (*Anisopteryx vernata*) and the elm leaf beetle, (*Galernca xanthomelæna*) which are often so destructive to the foliage of the elm, should make us hesitate against too exclusive setting of this most graceful tree. The elm leaf beetle is not yet in Michigan, but it is in New York, and only needs time to reach us. When it comes, we must either fight at great labor and expense, or else give up our elms.

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WHY NOT THE LINDEN OR BASS-WOOD?

Our American linden or bass-wood is a tree of rare beauty, and a more vigorous and rapid grower than either maple or elm. It is attacked very rarely by insects, and so far as I have observed I should say ten transplanted bass-woods live and thrive to one of maple. Last but not least, the linden is a very valuable honey tree, as the honey from bass-wood, is usually very plenteous and of most excellent quality, as we should expect from the delicious fragrance of the beautiful flowers. When we plant a linden, then, we are adorning our street, or grounds, with a tree that will very likely live and thrive, a tree that will surprise us with its rapid growth and development, and a tree that will bless the coming generation with the valuable product which it so bountifully yields. I believe there is no native deciduous tree that offers such inducements for transplanting as does the American linden.

Unless we conclude then to plant lindens exclusively, and such a course has much to recommend it, I should say plant all our beautiful trees: linden, maple, elm, oak, tulip, chestnut, ash, willow and even poplar, then, as with the man who practices mixed husbandry, and like the maid who divides her eggs among several baskets, we shall be almost sure to win at some point, and not to lose in all.

If it is thought that trees of one kind when planted in a single or double straight row look the best, then I say plant linden. If we plant irregularly, and pay some heed to grouping, which I have done, we can then plant all kinds of trees with excellent effect. Were it not for the inconvenience of this style of planting, when we come to use our mowers to cut the grass along the way side, I should certainly advise this irregular planting and grouping. Owing to the enhanced beauty, I prefer it even with the inconvenience thrown in.

To conclude, I say then, either plant lindens or else all our desirable native species. If we must set maples then practice great care that we may resist the borers and save our trees.

A. J. COOK,
Professor of Zoology and Entomology.

AGRICULTURAL COLLEGE, MICH.,
October 1st, 1888.

No. 40.—HORTICULTURAL DEPARTMENT.

EXPERIMENT AND OBSERVATION.

At this writing, Aug. 16th, as the Horticultural Department is transferred to other hands, the main experiments under progress are not completed.

Notes upon tomatoes, and some other vegetables, will be made by the writer at the close of the year. A few investigations may be reported here, however. It is necessary to state in this connection that the experiments undertaken by the department this year are not such as it has been contemplated

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to make leading features of true experiment station work. They are simply such as could be hastily undertaken under the pressure of college duties. In some part they were intended as suggestions and aids to students.

The past winter was not severe, in general, upon vegetation; yet Russian apricots, upon a well-drained slope, suffered much, and some trees, three years set and very vigorous, were killed outright. Sweet cherries, injured by previous winters, were killed, but in general little damage was done.

The minor and fragmentary investigations which it is intended now to report are as follows:

I. Quantity of Seed Required for Given Lengths of Drill.
II. Notes on Daturas.—An Experiment in Hybridization.
III. Notes on Radishes.
IV. Notes on Germination.
V. Effect of Latitude upon the Seasons of Flowering and Fruiting.

L. H. BAILEY,
Supt. Horticultural Dept.

AGRICULTURAL COLLEGE,
August 16, 1888.

I. QUANTITY OF SEED REQUIRED FOR GIVEN LENGTHS OF DRILL.—Careful records of the quantity of seed used in those vegetables ordinarily sown in drills shows that the quantity required is usually much less than that recommended by seedsmen. The following figures indicate the extent to which this is true, the quantities recommended being taken from Henderson's new "Gardening for Profit:"

Peas.—One quart to 100 feet of drill recommended; 850 feet of drill used four quarts of McLean's Advancer, or one quart to every 212½ feet; 850 feet of American Wonder required 3½ quarts, or one quart to about 245 feet of drill; 850 feet of McLean's Little Gem used three quarts, or one quart for every 283⅓ feet; 850 feet of Rural New Yorker used 3¼ quarts, or one quart for over 261 feet of drill; 850 feet of Cleveland's Alaska required three quarts, or one quart for 283⅓ feet. These figures indicate that the recommendations of Henderson are from over twice to almost three times too high. The following figures will show that our sowings were thick enough: One pint of McLean's Advancer contains 1,600 seed. A pint sowed a trifle over 106 feet of drill, giving something over 15 peas for every foot of drill, or a plant every four-fifths of an inch.

Radishes.—One ounce for 100 feet of drill recommended; 1,000 feet of drill, sown thickly to Early Long Scarlet Short-top, required 9½ ounces of seed. In this case the recommendation is not extravagant.

Beets.—One ounce to 50 feet of drill recommended. Long Dark Blood, Eclipse, and Bassano each required four ounces of seed for 334 feet of drill, or an ounce for 83½ feet, and the sowing was much too thick. An ounce of Long Dark Blood beet contains about 1,300 fruits or seed, or over 15½ fruits to each foot of drill, as we sowed them.

Parsnip.—One ounce to 200 feet of drill is recommended; 1,000 feet of drill of Hollow Crown took four ounces of seed, or an ounce to 250 feet of drill. The sowing was made in very hard ground where a thick growth of seedlings is necessary in order to break the crust. Yet the sowing proved over twice too thick.

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Carrot.—One ounce for 150 feet of drill recommended; 566 feet in hard ground used 1½ ounces of seed, or an ounce for over 377 feet of drill, and even then the stand was much thicker than desirable.

Salsify.—One ounce is recommended for 70 feet of drill; 7½ ounces were used in 558 feet, or an ounce for about 74½ feet of drill. In this case the estimates were correct.

II. NOTES ON DATURAS.—Last year several hybridizations were made between *Datura Stramonium* and *D. inermis* for the purpose of observing some of the results of hybridization. These plants were selected because they present fruits very dissimilar in external appearance and because they are easily handled. The particular result sought was to determine if there is an immediate effect of fertilization. Such effect did not occur, but the hybridizations were too few to furnish any adequate information upon this subject. The hybridized seeds were sown and notes have been taken upon the offspring, although the full fruiting is not yet apparent. The seeds from *Datura Stramonium* and *inermis* hybridizations, that is, those in which *D. Stramonium* was used as the pistillate parent did not germinate. The seeds from the reciprocal hybridization germinated readily, however. Eight plants from one hybridization bear at this time a total of 60 fruits, and thirty from another bear 216 fruits, or a total of 276 fruits from the union of *D. inermis* and *Stramonium*; *D. inermis*, the smooth fruited species, being used as the pistillate parent. All of these fruits are prickly exactly as are those of *D. Stramonium* the staminate parent, showing, apparently, that in this case the staminate parent has the most influence. The hybridizations from which these plants were obtained were made with exceeding care, and there can be no mistake concerning them. As a check to this experiment, which will be continued for years to come, it remains to be determined if self-fertilized seeds of *Datura inermis* always reproduce their kind; that is, if *D. inermis* is constantly specifically distinct from *D. Stramonium.*

Last October the writer found a plant of Datura in Washington, D. C., near the Washington monument, which bore fruits of very dissimilar characters. In general aspect the plant was like *D. inermis*, but the fruits varied all the way from the perfectly smooth ones of *D. inermis* to the very thorny ones of *D. Stramonium.* These fruits were collected and graded into four series, and the seeds were planted. At this writing, (Aug. 4th,) few fruits had set on the plants coming from these seeds, but all the fruits, from all the series, which had attained considerable size, are prickly throughout and the plants assume all the characters of *Datura Tatula.* The lateness of the plants and also the size (now 3½ to 4 ft. high) are evidently attributable to the effect of the latitude in which the seeds were grown. The plants were started in a forcing house, at the same time as those mentioned above.

III. NOTES ON RADISHES.—A number of varieties of radishes were grown this year upon a mucky soil between cauliflowers. Two hundred feet or more of drill was devoted to each variety. It is probable that the soil had much to do with the comparative earliness of varieties, as many of the sorts matured relatively later than they are usually supposed to do. The salient features which can be used in the classification and characterization of varieties of the radish are the following: Color of root; shape of root; size of root; position of root with reference to the surface of the soil, as to whether it grows mostly below the soil or stands well out of it; shade of top; size of top; date of maturity; quality.

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All the radishes which we grew,—some two dozen of the spring and summer sorts,—possess decided merits in their seasons. It is therefore difficult to name the best varieties. In a general way, it may perhaps be said that the following comprise the best sorts: Early white Turnip-rooted, White Olive-shaped, Large White Summer Turnip, Golden Globe, Yellow Summer Turnip, Black Summer Turnip, French Breakfast, Early Round Dark Red, Chartier, Early Long Scarlet, Wood's Early Frame. For market, the gray and black radishes are not often desirable, and the white ones do not ordinarily sell well early in the season, although they are sometimes used for mixing in with red varieties to make the bunches more attractive. As a rule, the white sorts are to be recommended for summer use.

In the following notes upon varieties of radishes, there has been no attempt to discover the oldest name for a given variety, inasmuch as a complete study of the radish has not been undertaken.*

The characters of the radish plant during flowering and fruiting may possibly prove useful in the determination of varieties. Differences in habit, size, and color and shape of flowers have been observed, but it is impossible to determine at present writing if these variations possess varietal value. In the following notes the periods of maturity and at which measurements are taken are those of the medium season of value for the table.

Series I.—White Radishes:

A.—Root turnip-shaped:

1. *Early White Turnip-rooted.*—Root almost perfectly turnip-shaped, about an inch in diameter each way when fully matured for the table, setting low in the ground; top light green, medium in height; early, mild in flavor when young.—From Ferry.
2. *White Olive-shaped.*—Very much like the preceding, but root inclining to be fusiform and setting higher in the ground, the top smaller; very early. Apparently a good sort for forcing.—From Ferry.
3. *Large White Summer Turnip.*—Drab or dull white in color, almost perfectly turnip-shaped, about an inch and a half in each diameter, setting high; top light green, large and high; late, mild and excellent in flavor. One of the best summer radishes.—From Ferry.
4. *Early White Giant Stuttgart.*—White, broadly fusiform or tapering turnip-shaped, the edible portion twice or thrice as long as broad (an inch or an inch and a half in diameter), setting very low in the ground; top light, large, as in the preceding; medium to late, good.—From Ferry.

B.—Root Long.

5. *White Strasburg.*—Clear white, fusiform, twice as long as broad, of medium position; top light in color, large, late, good.—From Ferry.
6. *Long White Vienna.*—Clear white, long, tapering or slenderly fusiform, five times longer than broad, of medium position; top dark, small for a radish of its class; medium to late, good to excellent. The *Long White Naples* was indistinguishable from this, although we thought that it tended somewhat to a more abrupt taper towards the point of the root.—Plants under both these names were grown from Ferry.

* A good study of synonymy will be found in Rept. N. Y. Exp. Sta. 1887, 146.

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Series II.—Black and Brown Radishes:

7. *Golden Globe.*—Light drab or gray, short fusiform or tapering turnip-shaped, the edible portion little longer than broad, setting low; top medium in color, small to medium in size; early, excellent.—From Ferry.
8. *Yellow Summer Turnip.*—Grayish black or blackish brown, broadly fusiform or turnip-shaped, an inch and a half in each diameter, low in position; top dark colored, medium in size; late. A good summer sort.—From Henderson.
9. *Gray Summer Turnip-rooted.*—Root covered with a thin coat of gray-black, turnip-shaped or somewhat fusiform, about as broad as long, low in position; top medium in color and size; late. A handsome variety.—From Ferry.
10. *Black Summer Turnip.*—Coal black, globular-fusiform, about an inch and a half in each diameter, low in the ground; top medium in color and size; late, good to excellent. Holds its quality a long time.—From Henderson.

Series III.—Purple or Violet Radishes:

11. *Violet Olive-shaped,* white-tipped.—Light purple, oblong and abruptly contracted at the base, or varying to imperfectly fusiform, an inch thick and two or three times as long, setting high in the ground; top medium in color, small to medium; medium to late.—From Henderson.
12. *Violet Turnip,* white-tipped.—Much like the last, but globular in shape and setting low in the ground.—From Henderson.

Series IV.—Red Radishes:

A.—Root turnip-shaped:

13. *Early Scarlet Turnip,* white-tipped.—Bright scarlet, tips clear white, turnip-shaped or globular, an inch or so in diameter, medium in position; top dark, medium in size; early. A handsome radish.—From Ferry.
14. *Early Round Deep Scarlet.*—Bright scarlet, turnip-shaped or fusiform, an inch and a half long by an inch broad, position medium; top medium in color, very small; early to medium.—From Ferry.
15. *Red Forcing Turnip.*—Turnip-shaped, tending to become irregular, about an inch and a half in each direction, standing high above ground; top light, medium to large in size; medium to late.—From Henderson.
16. *French Breakfast.*—Turnip-shaped to short-fusiform, often irregular, half longer than broad, standing high in the ground; top medium in color, small to medium, early to medium. Useful for forcing.—From Ferry.
17. *Early Scarlet Turnip-rooted.*—Turnip-shaped or very short-fusiform, sometimes irregular, a half longer than broad, medium in position; top medium in color, medium to small in size, medium to late. Scarcely distinguishable from the last. Sets lower in the ground than the French Breakfast.—From Ferry.
18. *Early Round Dark Red.*—Scarcely distinguishable from the last. It averages, perhaps, somewhat darker in color. These two are very like *Violet Turnip,* save in color. Good for forcing.—From Henderson.

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19. *Early Scarlet Globe.*—Fusiform, often rather slender, standing low in the soil; top medium in color, small; medium in season.—From Henderson.

B.—Oblong Radishes (*abruptly contracted at the base*):

20. *Rose.*—Two inches or more long, irregularly cylindrical, standing high in the ground; top dark, medium; medium to late. Closely resembles *Violet Olive-shaped*, except in color.—From F. B. Mills, Thorn Hill, N. Y.

C.—Long Radishes:

21. *Shepherd.*—Long and gradually tapering, four or five inches long by an inch in diameter, tips white, standing low in the ground; top dark, large; late. Has too many large side roots.—From F. B. Mills, Thorn Hill, N. Y.
22. *Chartier* (*Improved Chartier*).—Long and slender (five times or more longer than broad), bright red above but becoming very white towards the tip, low in position; tops dark, large; late, excellent. A fine sort.—From Ferry.
23. *Early Long Scarlet Short-top*, Improved.—Long and slender (five or six times as long as broad), scarlet above, whitish on the lower fourth, high in position; tops dark, medium; medium in season, good. A standard sort.—From Ferry.
24. *Wood's Early Frame.*—Long-tapering as in the last, or perhaps somewhat shorter, very dark red above, becoming whitish on the lower fourth, standing high; tops dark, medium in size; medium, good.—From Ferry.

NOTES ON GERMINATION.—The influence of certain chemical agents upon germination received some attention last year, and the results were published in the last report of this department. The subject received careful investigation this year, with indifferent results. These experiments were conducted in the forcing house with all the care possible. They were intended as preliminary tests in order to determine the most promising agents for experimentation in field culture. The tests gave comparatively unsatisfactory results, however, and field experiments were not attempted. It appears probable that seeds of different species behave differently under treatment by the same agent. The subject of hastening germination by means of various solutions has been discussed for a half century, yet there is no settled opinion concerning it. This fact is proof that decided effects from the use of chemicals have not been generally obtained. The reasons why such effects are supposed to be possible are entirely theoretical and apparently largely incorrect. Inasmuch as carbon dioxide is evolved during germination, it has been supposed that oxidizing agents, by giving oxygen to unite with the carbon of the seed and thereby form carbon dioxide, must hasten germination. There are chemical reasons why this proposition is unsound, but the following experiments give obvious proof of its fallacy.

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EXPERIMENT I.—*Corn.*

Conducted in November and December in clean and air-dry sand, one box sixteen inches square being devoted to each agent. The same amount of solution was used to water each box, as near as amounts could be determined at the time. One hundred kernels were planted in each box, the seed all being taken from the same lot.

Substances.	118 hrs.	137 hrs.	145 hrs.	161 hrs.	185 hrs.	209 hrs.	221 hrs.	237 hrs.	245 hrs.	261 hrs.	269 hrs.	285 hrs.
Oxidizing Agents:												
Permanganate of Potash ($K M N O_4$)	....	2	2	28	30	15	....	9	....	4	1	2
Chlorate of Potash ($K Cl O_3$)	....	....	....	7	9	11	....	16	1	8	3	3
Nitrate of Potash ($K N O_3$)	....	....	....	17	36	20	4	9	3	2	....	....
Bichromate of Potash ($K_2 Cr_2 O_7$)	....	....	....	....	....	4	1	1	....	4	4	7
Nitrate of Soda ($Na_2 N O_3$)	....	1	....	3	28	24	....	5	....	2	1	1
Nitrate of Lead ($Pb (N O_3)_2$)	....	....	1	12	31	25	3	7	....	5	2	....
Peroxide of Hydrogen ($H_2 O_2$)	....	....	....	3	33	27	3	2	2	....	....	....
Nitric Acid ($H N O_3$)	....	....	....	2	26	30	5	9	7	6	5	....
Reducing Agent:												
Hyposulphite of Soda ($Na_2 S_2 O_3$)	....	3	....	19	32	22	5	5	5	3	....	....
Neutral Agents:												
Acetate of Lead ($Pb Á$)	....	5	4	23	37	13	3	3	2	2	....	1
Lime-water	....	3	....	20	46	16	3	7	....	2	....	....
Ordinary well-water	8	15	9	33	23	6	....	2	....	....	....	....

It will be observed that water gave the earliest germinations, and acetate of lead the second earliest. The most tardy results were obtained from the use of bichromate of potash. It will be noticed, also, contrary to the common notion, that hyposulphite of soda, a reducing agent, gave better results than most of the oxidizing agents. The best percentages of germination in 285 hours, occurs as follows: lime-water, 97; water, 96; hyposulphite of soda, 94; acetate of lead, 93; permanganate of potash, 93; nitrate of potash, 91; nitric acid, 90; nitrate of lead, 86; peroxide of hydrogen, 70; nitrate of soda, 65; chlorate of potash, 58; bichromate of potash, 21.

EXPERIMENT II.—*Corn and Beans.*

One hundred kernels of corn and seventy beans were treated to each agent, in the same manner as in the preceding experiment. The corn and beans occupied the same box in each case.

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Substances.	190 Hours.		214 Hours.		238 Hours.		283 Hours.		350 Hours.		Percentages—350 Hours.	
	Beans.	Corn.	Beans.	Corn.	Beans.	Corn.	Beans.	Corn.	Beans.	Corn.	Beans.	Corn.
Oxidizing Agents:												
Permanganate of potash	61	35	1	7	0	11	2	2	5	9	98	64
Chlorate of potash	31	4	0	4	0	7	1	9	10	10	60	34
Nitrate of potash	19	9	2	13	3	3	0	3	3	7	45	40
Bichromate of potash	0	0	2	6	0	0	0	12	10	7	17	25
Nitrate of soda	3	11	0	6	9	14	3	10	9	6	41	47
Nitrate of lead	49	24	1	2	0	19	0	10	17	16	95	71
Peroxide of hydrogen	29	29	3	13	1	10	0	5	7	14	57	71
Nitric acid	19	22	0	4	2	16	3	10	22	16	65	68
Reducing Agent:												
Hyposulphite of soda	9	16	2	9	7	20	7	5	3	21	47	71
Neutral Agents:												
Acetate of lead	60	40	0	16	4	3	2	1	1	23	95	83
Lime water	13	63	0	6	5	11	2	2	2	3	39	90
Ordinary well water	24	36	0	9	5	4	2	4	9	9	57	62

This experiment is instructive by showing the different behaviors of corn and beans under the same conditions, and, by comparison with experiment 1, in showing the variation of the same seed under treatment with the same agents, the corn in the two experiments having been taken from the same lot. The earliest germinations of corn were obtained as follows: Lime-water, 63 per cent in 190 hours; acetate of lead, 40 per cent; water, 36 per cent; permanganate of potash, 35 per cent; peroxide of hydrogen, 29 per cent; nitrate of lead, 24 per cent; nitric acid, 22 per cent. In this experiment, as in the other, the poorest results were obtained with bichromate of potash. The earliest germinations of beans were obtained with the following agents: Permanganate of potash, 61 per cent in 190 hours; acetate of lead, 60 per cent; nitrate of lead, 49 per cent; chlorate of potash, 31 per cent; peroxide of hydrogen, 29 per cent; water, 24 per cent. The best percentages of germination in corn in 350 hours are as follows: lime water, 90; acetate of lead, 83; nitrate of lead, peroxide of hydrogen, hyposulphite of soda, each 71; permanganate of potash, 64; nitric acid, 68; water, 62; nitrate of soda, 47; nitrate of potash, 40; chlorate of potash, 34; bichromate of potash, 25. Beans: permanganate of potash, 98 per cent; nitrate of lead and acetate of lead, 95; nitric acid, 65; chlorate of potash 60; peroxide of hydrogen and water, 57; hyposulphite of soda, 47; nitrate of potash, 45; nitrate of soda, 41; lime water, 39; bichromate of potash, 17.

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EXPERIMENT III.—*Cabbage.*

[Conducted by L. A. Bregger.]

These seeds, all from the same lot, were soaked 18 hours in the various solutions, and then sown a quarter inch deep in sand, and watered thereafter as occasion required. The seeds not soaked were planted in an outside row, and the soil being somewhat lower there, the seeds received an extra amount of water. Perhaps a part of the result with this row, may be attributed to this circumstance. 100 seeds of each.

Substance.	4th day.	5th day.	6th day.	7th day.	8th day.	9th day.	10th day.	11th day.	12th day.	13th day.	14th day.	15th day.	16th day.	17th day.	18th day.	19th day.	20th day.	Per cent. of germ.
Permanganate of potash.	....	1	1	....	....	3	....	2	....	....	2	....	1	....	1	....	....	11
Chlorate of potash	....	....	....	1	....	1	3	....	3	....	2	....	....	....	....	....	1	11
Nitrate of potash	....	....	1	3	....	1	....	3	....	....	1	....	....	....	....	....	....	9
Bichromate of potash	....	....	3	....	....	....	....	1	1	....	....	1	....	....	2	....	....	8
Nitrate of soda	....	....	....	1	....	1	....	....	....	....	2	....	....	....	....	....	....	
Nitrate of lead	....	2	2	6	1	2	5	3	5	1	2	....	1	....	....	1	....	31
Peroxide of hydrogen	....	2	1	3	....	1	3	....	....	....	....	....	....	....	....	....	1	11
Nitric acid	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Hyposulphite of soda	....	....	3	1	....	7	2	1	....	1	....	....	1	....	....	....	1	17
Acetate of lead	....	....	6	2	1	....	7	4	3	....	5	....	....	2	1	....	....	31
Lime water	....	....	....	....	....	2	1	....	1	....	....	....	....	....	....	....	....	4
Water	....	2	....	1	2	1	2	....	1	....	1	....	1	....	....	....	....	11
Not soaked	3	29	5	2	2	1	3	....	1	1	5	....	1	....	....	....	....	53

Here the best and earliest germinations were secured from seeds not treated. The best percentages were as follows: Not treated, 53 per cent. at the end of 20 days; nitrate of lead and acetate of lead, 31; hyposulphite of soda, 17; permanganate of potash, chlorate of potash, peroxide of hydrogen, and water, each 11; nitrate of potash, 9; bichromate of potash, 8; nitrate of soda and lime water, 4; nitric acid, 0.

EXPERIMENT IV.—*Cabbage.*

[Conducted by L. A. Bregger.]

This experiment was conducted the same as experiment III, except that the soaking was continued forty-eight hours. The seeds were from a different lot than those in the former experiment.

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Substance.	4th day.	5th day.	6th day.	7th day.	8th day.	9th day.	10th day.	11th day.	12th day.	13th day.	14th day.	15th day.	16th day.	17th day.	18th day.	19th day.	20th day.	Per Cent.
Permanganate of potash	5	6	6	10	2	3	2	3	....	2	1	....	2	....	....	....	....	42
Chlorate of potash	....	1	5	2	5	7	7	4	....	2	1	2	1	1	....	....	....	38
Nitrate of potash	18	23	16	1	....	2	2	2	....	5	1	....	....	1	....	....	1	72
Bicarbonate of potash	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1	....	....	2
Nitrate of soda	24	29	1	3	....	1	1	2	....	1	1	....	....	....	....	....	....	63
Nitrate of lead	2	9	9	2	2	3	9	2	1	7	1	3	1	....	....	1	....	52
Peroxide of hydrogen	46	7	2	....	....	3	2	4	....	2	1	1	....	....	....	....	1	69
Nitric acid	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Hyposulphite of soda	11	23	21	2	1	1	1	2	....	1	1	1	....	....	....	....	....	65
Acetate of lead	7	11	10	3	10	1	7	3	2	1	....	3	2	1	....	2	....	68
Lime water	....	12	4	2	2	1	....	3	....	1	....	....	....	....	....	1	....	26
Water	41	12	1	2	2	1	....	....	....	1	....	2	1	....	....	....	....	63
Not soaked	....	2	29	3	3	....	3	3	1	4	1	....	....	1	....	1	....	56

The earliest germinations in this experiment were obtained by peroxide of hydrogen, 46 per cent, and water, 41 per cent. The best percentages at the end of 20 days read as follows: Nitrate of potash, 72; peroxide of hydrogen, 69; acetate of lead, 68; hyposulphite of soda, 65; nitrate of soda, and water, 63; not soaked, 56; nitrate of lead, 52; permanganate of potash, 42; chlorate of potash, 38; lime-water, 26; bichromate of potash, 2.

EXPERIMENT V.—*Cabbage.*

[Conducted by L. A. Bregger.]

Conducted the same as the last two experiments, except that the seeds were soaked eight hours. The seeds were of the same lot as those in Experiment IV.

Substance.	5th day.	6th day.	7th day.	8th day.	9th day.	10th day.	11th day.	12th day.	13th day.	14th day.	15th day.	16th day.	17th day.	18th day.	19th day.	20th day.	Per cent.
Permanganate of potash	33	8	3	....	....	2	1	1	1	2	....	1	....	....	....	....	53
Chlorate of potash	35	23	1	....	1	2	....	1	2	....	1	1	....	1	....	....	68
Nitrate of potash	40	9	2	....	3	3	1	3	2	1	1	....	....	....	....	....	65
Bichromate of potash	....	7	12	7	....	6	2	1	2	1	3	6	1	1	....	....	49
Nitrate of soda	41	7	2	3	1	3	....	2	2	....	....	....	....	....	....	....	61
Nitrate of lead	37	11	5	4	1	1	1	2	2	2	1	1	....	1	....	....	69
Peroxide of hydrogen	59	2	3	....	1	2	1	1	....	1	2	....	....	....	....	....	72
Nitric acid	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Hyposulphite of soda	38	6	....	2	....	4	3	4	2	1	1	1	1	2	....	....	65
Acetate of lead	25	14	3	9	3	3	1	7	...	2	1	2	....	....	....	....	70
Lime-water	15	11	3	1	1	...	....	2	1	....	1	....	....	....	1	....	36
Water	36	25	3	1	1	2	....	3	1	....	....	1	....	....	....	....	73
Not soaked	....	24	18	6	1	2	3	1	....	....	....	....	1	1	....	....	57

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The earliest germinations were obtained by peroxide of hydrogen, 59 per cent., nitrate of soda 41, nitrate of potash 40, hyposulphite of soda, 38, nitrate of lead, 37, water, 36, chlorate of potash, 35. The best percentages at the close of 20 days arrange themselves as follows: Water, 73; peroxide of hydrogen, 72; acetate of lead, 70; nitrate of lead, 69; chlorate of potash, 68; nitrate of potash, and hyposulphite of soda, 65; nitrate of soda, 61; not soaked, 57; permanganate of potash, 52; bichromate of potash, 49; lime water, 36; nitric acid, 0.

Comparing Experiments III., IV., V., it is evident that the seeds soaked forty-eight hours (IV.), gave much earlier germinations than the others, and that those soaked eighteen hours gave the second earliest results. The best aggregate percentages were obtained from those soaked eight hours (V.), the second best from those soaked forty-eight hours. Computing an average action for the substances employed in the three experiments, we have the following:

Substances.	Average per cent. of Germination at the end of 5 Days.	Average per cent. of Germination at the end of 20 Days.
Permanganate of potash	15	35
Chlorate of potash	13	39
Nitrate of potash	27	48⅓
Bichromate of potash	0	19⅔
Nitrate of soda	31⅓	42
Nitrate of lead	16⅔	50⅔
Peroxide of hydrogen	38	50⅔
Nitric acid	0	0
Hyposulphite of soda	24	49
Acetate of lead	14⅓	56⅔
Lime-water	9	22
Water	30⅔	49
Not soaked	11⅓	55⅓

The time of germination is not profitably hastened by any substance as compared with water, only two agents giving earlier results of slight importance. The total average of germination is not appreciably greater in any case than in the seeds untreated. The figures in the last two experiments give marked testimony to the earlier results to be obtained by soaking seeds in water as compared with those not treated, the difference being most marked in the case of those soaked forty-eight hours.

It will be seen that lime-water, which had an important influence upon corn and beans, gives poor or indifferent results with cabbage seeds. Similar variations, somewhat constant, appear in the use of other agents. The following test with peas, carried only far enough to indicate the earliest germinations, will be useful for comparison in this connection. The five agents which gave the best results in the experiments with corn were selected, and the commercial chloride of lime was added:

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EXPERIMENT VI.—*Peas.*

The peas were planted in sand and watered with the various solutions.

Substances.	50 Hours.	92 Hours.	140 Hours.
Nitrate of lead	54	19	1
Peroxide of hydrogen	23	36	9
Nitrate of potash	0	7	15
Acetate of lead	1	12	19
Chloride of lime	55	12	1
Water	45	23	8

The results at the expiration of about seven and a half days show that nitrate of lead is ahead, showing 73 per cent of germination, but water gave practically as good results.

It has been stated by writers upon gardening that there is a difference in rapidity of germination between seeds treated with hard water and those treated with soft water. A couple of tests were made upon this suggestion.

EXPERIMENT VII.—*Corn.*

The corn was planted in sand in twelve small boxes, six being watered with hard well water and six with soft (rain) water.

Hard Water.						Soft Water.					
	60 Hours.	102 Hours.	154 Hours.	220 Hours.	272 Hours.		60 Hours.	102 Hours.	154 Hours.	220 Hours.	272 Hours.
Box No. 1	4	3	6	0	1	Box No. 7	0	2	2	1	1
" No. 2	0	1	2	2	1	" No. 8	9	1	2	0	1
" No. 3	2	1	5	2	1	" No. 9	1	9	7	4	0
" No. 4	2	1	4	1	2	" No. 10	6	1	4	1	0
" No. 5	12	1	2	0	0	" No. 11	18	0	2	0	0
" No. 6	9	3	2	0	0	" No. 12	11	1	2	0	0
Totals	29	10	21	5	5	Totals	45	5	19	6	2
General total	70					General total	77				

There was a considerable gain in earliness of germination in the treatments with soft water, yet the experiment, when repeated, gave different results. It is remarkable that there should have been such great differences in the rates of germination between contiguous boxes watered alike, and in which the seeds were all selected from the same lot. This circumstance is illustration of the fact that permanent results can not be reached from isolated experiments. Experiments were also made upon germination of cabbage seeds which had

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been treated with lime-water and well-water. The well-water gave the earlier results but the lime-water gave the better total percentages; yet the differences were not sufficiently marked to indicate any permanent or practical value of one over the other.

A few other experiments upon germination were undertaken, larg ly, as suggestions to students. One of the most interesting of these had to do with the comparative germinations of light and heavy radish seeds. Eighteen packets of different varieties, each packet containing several ounces, were stood on edge in a box and were then placed in a buggy which was driven over eight miles of smooth road. The packets were then carefully opened at each end and one hundred seeds taken from the top and bottom, and planted at equal depths. The heavier seeds which were taken from the bottoms of the packets germinated somewhat sooner than those from the top of the packets, and the young plants which they gave were clearly stronger, so much stronger as to draw the attention of all observers. The plants did not appear to hold their superiority after the true leaves were developed, however. The experiment was conducted by a student, and, unfortunately, numerical records were not kept. The following tests were made upon radish and cabbage seeds which sank in water as compared with those which floated.

EXPERIMENT VIII.—*Radishes and Cabbages.*

[Conducted by L. A. Bregger.]

Seeds.	5th day.	6th day.	7th day.	8th day.	9th day.	10th day.	11th day.	12th day.	13th day.	14th day.	15th day.	16th day.	Total.
Radishes. 100 seeds which sank in water	89	5	1	2	....	....	....	....	....	....	....	....	97
Radishes. 100 seeds which floated	60	12	5	....	....	1	2	1	....	....	....	....	81
Cabbage. 50 seeds which sank in water	....	....	5	12	2	2	....	....	....	....	....	....	21
Cabbage. 50 seeds which floated	....	....	1	8	1	4	....	....	1	2	2	1	20

The heavy radish seeds show a decided advantage, both in rapidity of germination and total number of germinations at the expiration of sixteen days. There was no appreciable difference between the two sets of radishes in general vigor. The heavier cabbage seeds show less superiority in figures, yet the differences between the growing plantlets were considerable. Those from the floated seeds were much weaker than the others, and four died before the close of the experiment.

An experiment was made by W. A. Taylor to determine the proper depth at which to plant beans in sand to insure best germination. The highest per cent. of germination was obtained from seeds planted three-fourths inch deep, and the next best from those planted one inch, there being a difference between the two of eleven per cent. At the time this experiment was conducted the weather was cool and the seeds planted deeper probably did not receive sufficient heat from the sun. Seeds planted three and four inches deep gave fifteen per cent. less germination at the end of twenty days than those planted three-fourths inch, yet the plants coming from this deep seeding were much stronger than the others, owing to the fact that there was sufficient depth of soil to aid in removing the tightly enveloping seed coats,

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while the seed coats adhered to the cotyledons and constricted growth in the other case. In fact, at the expiration of twenty days, the total growth of plants from the three and four inch plants was at least four times as much as that from the three-fourths inch planting. Hence it follows that the depth which gives greatest percentage of germination is not necessarily the one which gives the most profitable results. In the soil upon which this test was conducted, the gardener would find more profit in beans planted four inches deep than in those planted three-fourths inch.

V. Effect of Latitude upon the Season of Flowering and Fruiting.—In order to learn something of the extent to which latitude influences the acceleration or retarding of vegetation, about 2,600 circulars were addressed to leading fruit-growers from Michigan to the Gulf States, asking for the dates at which specified varieties of fruit plants blossom and mature their fruit. About one hundred and fifty replies were received. The varieties selected are those which are most commonly cultivated over a wide range of latitude. The tabulated records of these observations are presented below. It is not advisable to draw conclusions from so few observations, and the records are published for future comparison. It will be noticed that the replies from the same latitude often indicate differences as great as those which exist between several degrees of latitude. These differences are to be accounted for by differences in elevation, exposure, soil and culture; and in some cases, no doubt, the replies are erroneous. To eliminate such unavoidable errors, many hundreds of observations must be recorded. No doubt the best manner in which to secure reliable information concerning effects of latitude, were it possible, would be to compare observations made in a few representative places; but it is probably impossible to determine upon places which are not largely influenced by local environments. A study of the results recorded in the following tables, indicate that between latitudes five and ten degrees removed there are differences of five and six days for every degree in the periods of flowering of apples, peaches, blackberries, and strawberries.

Table I.—*Early Harvest Apple.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Thomasville	Ga.	31°	March 10	July 10	
Marshallville	"	32½	" 10-15	June 1	
La Grange	"	33	" 1-15	" 10-20	
Spartanburg	S. C.	33	April 1	August 12	
Augusta	Ga.	33½	March 27	May 30	
Columbus	Miss.	33½	" 20-April 5	" 30-June 15	
Atlanta	Ga.	34	April 8-12	About July 1	
"	"	34	" 1	" " 20-30	
Denison City	Tex.	34	" 5-15	June 20-July 10	
Fayetteville	N. C.	35	" 12	June 15	
Vineyard	"	35½	" 10	July 10	
Salisbury	"	35½	" 10	June 15	

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TABLE I.—*Continued.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Hamburg	S. C.	35½	April 1-10	June 10	
Vandalia	N. C.	36	" 15	July 4-15	
Raleigh	"	36	" 1-10	June 25-July 10	
Shore	"	36	March 15	June 30 & early July	
Greensboro	"	36	April 15	June 23	
Greensboro	"	36	" 1	July 15	
Lenoir	"	36	" 1	Late May, early June	
Point Pleasant	Mo.	36½		" 1-30	
Ridgeway	N. C.	36½	April 15	" 15	
Wellington	Ks.	37+	" 1-15	" 15-25	Highly esteemed
Doniphan	Mo.	37-	" 5	" 15	
Carthage	"	37+	" 10	June 28	
Piedmont	"	37+	" 15	July 1	
Alton	"	37	March 15-April 10	June 15-July 20	
Cherryvale	Ks.	37½	April 10	July 25	
Milford	Mo.	37½		June 15	
Barry	Ks.	38	April 15-20	July 8	
Peabody	"	38	" 20	" 1	
Gordon	"	38-	" 10-15	June 29	
Mulberry	Mo.	38+	" 1-10	June 20-30	
Fairfield	"	38	" 12	July 1	
Emporia	Ks.	38½	" 23	" 15-20	
Americus	"	38½	" 15-30	" 1	
New Albany	Ind.	38½	" 18	" 10	
Clinton	Mo.	38½	" 12	" 10	Sometimes earlier.
"	"	38½	" 15	"	
St. Louis	"	38½	" 21		
Gasconade	Mo.	38½	April 15	July 7	
Bluffton	"	38½	" 20	" 5	
Riley Center	Ks.	39+	" 28	" 10	
Manhattan	"	39	" 20	" 10	
Waveland	"	39	" 15	" 4-15	
Fairmount	"	39	" 17	" 10	
Holton	"	39+	" 25	" 10	
Detroit	"	39-	" 15-20	" 10	
Bartle	Ind.	39	May 1	June 20	
Boonville	Mo.	39	April 25		
Harlem	"	39	" 20	July 10	
Richmond	"	39	" 30	August 1	

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TABLE I.—*Continued.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
New Florence	Mo.	39	April 21	July 4	
Boonville	"	39	" 15-25	June 20-25	
Easton	Ks.	39½	" 25	" 30	
Invermay	"	39½	" 30		
Monrovia	"	39½	" 25-May 10	July 1-15	
Bridgeton	N. J.	39½		August 1	
Deerfield	"	39½	May 8	July 20-August 15	Spring 10 days late.
Greencastle	Ind.	39½	April 15	July 15	
Bloomingdale	"	40	" 10	" 1	
Manalapan	N. J.	40+	May 10	" 20-25	
New Ross	Ind.	40	April 28	August 1	
Barnesville	Ohio	40	" 8	July 15	
Dayton	"	40	" 15-20	August	
Springfield	"	40	" 25-28	"	
Whitesville	Mo.	40	May 1		
Bolton	"	40	April 18	August 10	
Indiana	Pa.	40½	May 8-15	Last of July	
New Brunswick	N. J.	40½	" 10-15	July 25-30	
St. Johns	Mo.	40½	" 1	" 15-August 15	
Denmark	Iowa	41	" 1	" 20	
La Plume	Pa.	41½	" 10-15	August 1	
McLane	"	42	" 15	" 1	
Erie	"	42	" 20-25	" 10-25	
Penn Yan	N. Y.	42½	" 23	July 11	
Wright's Corners	"	42½	" 14	August 10	
North Collins	"	42½	" 12-17	September 1	
Ithaca	"	42½	" 10	July 28	
Geneva	"	43-	" 13	" 20	
Lyons	"	43	" 20	August 10	
Sodus	"	43+	" 20	July 25-August 5	
"	"	43+	" 5-25	August 1-15	
Rochester	"	43+	" 22		
"	"	43+	" 23	August 21	
"	"	43+	" 19	" 1	
Webster	"	43	" 22	" 22	
Greece	"	43	" 17		
Auburn	"	43	" 20	August 15	
Geneva	"	43-	" 17	July 20	
Union Springs	"	43-	" 23	" 15-30	
Brockport	"	43	" 18-20	August 1	
Spencerport	"	43+	" 15-20	July 15-30	

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TABLE II.—*Alexander Apple.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Thomasville	Ga.	31			Not grown.
Americus	"	32			" "
Marshallville	"	32½			Not grown S. of 36°
Ridgeway	N. C.	36½	March 25	June 10	
Pt. Pleasant	Mo.	36½	April 9		All apples in bloom April 9.
Doniphan	"	37 -	" 10	October 15.	
Wellington	Ks.	37 +	" 1-15	September 15	Shy bearer—not recommended.
Sawyer	"	37½			Trees too young to bear.
San Leandro	Cal.	37½	April 1-10	July to September	All varieties considered.
Mulberry	Mo.	38 +	" "		All varieties considered.
Boonville	"	39	" 20-30	About September 1	Not many grown here
Beaman	"	39	About April 24	Dec. and Jan.	All varieties considered.
Benton City	"	39	April 20		All varieties considered.
Lawrence	Ks.	39		August 20	
Bolton	Mo.	40	April 20	September 20	
Oregon	"	40	June	November	
Springfield	Ohio	40	May 1-4	October	
Dayton	"	40	Last of Apr. & May 1	November	
Barnesville	"	40	April 10	October 15	
Winchester	Ind.	40	" 10-12		
Dickeyville	Ks.	40	" 25	October	All apples considered
ndiana	Pa.	40½	May 8-15	August 1	
Denmark	Ia.	41	" 1	October 20	
La Plume	Pa.	41½	" 8-15	October 1	
Ithaca	N. Y.	42½	" 10	August 25	
Janesville	Wis.	42½	" 21-26	September 10-15	
Brockport	N. Y.	43	" 20	October 15-20	
Geneva	"	43	" 19		
Greece	"	43	" 21	Sept. 10-Oct. 1	
Rochester	"	43	" 16	September 10	
"	"	43	" 23	September 14	
"	"	43	" 25-28		
Romulus	"	43	" 20-25		
Sodus	"	43	" 27-June 1	October 20-25	
Ithaca	Wis.	43	" 15	Sept. 25-Oct. 10	

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TABLE III.—*Rhode Island Greening Apple.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Americus	Ga.	32	March 25-April 5	October	
Greensboro	N. C.	36	April 1	December	
Lenoir	"	36	" 1	Last of August	
Cherryvale	Ks.	37½	" 10	October 20-January 1	
Barry	"	38	" 20-25	March 1	
Fairfield	Mo.	38	" 21	Winter	
Emporia	Ks.	38½	" 25	September 20-25	"Degenerated into a summer apple."
Clinton	Mo.	38½	" 20	September 15	
Clinton	"	38½	" 18	November	
Bluffton	"	38½	" 27	December to Feb.	
Manhattan	Ks.	39	" 24		
Waveland	"	39	" 15	January to March	
Detroit	"	39	" 15-20	November	
Bartle	Ind.	39	May 2	October	
New Florence	Mo.	39	April 29		
Boonville	"	39	" 25	September 20	
Monrovia	Ks.	39½	" 25-May 10	October 15	
Deerfield	N. J.	39½	May 10	Sept. 10-Oct. 1	
New Ross	Ind.	40	April 24	December 1	
Manalapan	N. J.	40	May 12	Winter	
Barnesville	Ohio	40	April 10	December 20	
Springfield	"	40	" 28-30	January	
Oregon	Mo.	40	June 2-5	October	
Bolton	"	40	April 20	November	
Indiana	Pa.	40½	May 8-15	January	
New Brunswick	N. J.	40½	" 10-15	October 1-15	
Denmark	Iowa	41	" 1	December 25	
La Plume	Pa.	41½	" 15-20	January 1	
McLane	"	42	" 20	December	
Erie	"	42	" 27	Nov. and December	
Penn Yan	N. Y.	42½+	" 25	January 1	
Portageville	"	42½+	" 20-30	December	
Wright's Corners	"	42½+	" 16	December 1	
North Collins	"	42½+	" 12-17	January 1	
Ithaca	"	42½+	" 12	" and Feb.	
Grand Rapids	Mich.	43	" 25	December 20	
Lyons	N. Y.	43	" 20	January 1	
Sodus	"	43+	" 20-27	October 20-25	
Lockport	"	43+	" 15	Dec. and March	
Sodus	"	43+	" 5-25	Jan. 1 to March 1	
Rochester	"	43+	" 23-30	January 10	
Greece	"	43+	" 21	" 15-Feb. 15	
Auburn	"	43	" 22	December 15	

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TABLE IV.—*Baldwin Apple.*

Postoffice.	ate.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Spartanburg	S. C.	38°	April 4	September 10	
Columbus	Miss.	33½	March	August	
Fayetteville	N. C.	35	April 5	September 1	Does not mature.
Raleigh	"	36-	" 1-10	September	
Shore	"	36	Last of March	Oct. and Nov	
Greensboro	"	36	April 1	Midwinter	
Doniphan	Mo.	37-	" 10	October 15	
Piedmont	"	37+	" 20		
Alton	"	37	March 20-April 10	Sept. 10 to Oct. 10	
San Leandro	Cal.	37½	April 1-10	July to September	All varieties.
Barry	Ks.	38	" 20-25	January 1	
Peabody	"	38	" 24	" 20	
Clinton	Mo	38½-	" 20	November	Date of blossoming at least 1 mo. later than last year.
Emporia	Ks.	38½	" 25	January 1	
New Albany	Ind.	38½	" 20	Sept. 25	
Clinton	Mo.	38½	" 20	October 15	
Bluffton	"	38½	" 25	December to Feb	
Manhattan	Ks.	39	" 20	September 15	
Waveland	"	39	" 15	January to March	
Bartle	Ind	39	May 2	September and Oct	
Belpre	Ohio	39+	April 15	September to Dec	Too far north to be reliable.
Boonville	Mo	39	" 20		
New Florence	"	39-	" 24		
Boonville	"	39	" 20-30	September 1	
Deerfield	N. J.	39½	May 10	Sept. 25 to Oct. 15	
Greencastle	Ind.	39½	April 27	Last of September	
Winchester	"	40	May 10-20		
Manalapan	N. J.	40+	" 12	Winter	
New Ross	Ind.	40	April 25	December 25	Average for 10 years
Barnesville	Ohio	40	" 12	" 15	
Dayton	"	40-	" 30	September	
Springfield	"	40	May 6-8	February	
Oregon	Mo	40	June	November	
Indiana	Pa.	40½	May 8-15	February	
New Brunswick	N. J.	40½	" 10-15	October 10-15	
Denmark	Iowa	41	" 1	December 20	
La Plume	Pa.	41½	" 1-25	February 1	
McLane	"	42	" 20	December	
Erie	"	42		" 1	

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TABLE IV.—*Continued.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Penn Yan	N. Y.	42½+	May 25	February 1	
Portageville	"	42½+	" 20-30	December	
Wright's Corners	"	42½	" 18	January 1	
North Collins	"	42½	" 12-17	February 1	
Ithaca	"	42½	" 14	January and Feb	
Lyons	"	43	" 20	January 1	
Sodus	"	43+	" 20 to June 1	October 20-28	
"	"	43+	" 5-25	Feb. 1 to March 1	
Lockport	"	43+	" 15	January to April	
Romulus	"	43-	" 20-25		
Rochester	"	43+	" 27-30		
New Hartford	"	43	Last of May	January 1 to Feb. 1	
Rochester	"	43+	May 24	January 28	
"	"	43+	" 18	November 1	
Webster	"	43+	" 22	December 20	
Greece	"	43+	" 22	Feb. 15 to March 15	
Auburn	"	43	" 22	December 15	
Geneva	"	43-	" 26		
Medina	"	43+	" 18-28	February 1 to May	Blossom usually at earlier date.
Union Springs	"	43-	" 10-25		
Brockport	"	43	" 25-28	Nov. 1 to Jan. and Feb.	
Spencerport	"	43+	" 20-25	Jan. 15 to April 1	

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TABLE V.—*Ben Davis Apple.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Thomasville	Ga.	31-	March 10	September 10	
Americus	"	32	" 25-April 5	November	
Greenville	Ala.	32-	" 15-April 1		All varieties of apples.
Marshallville	Ga.	32½	" 15-20	October 25	
La Grange	"	33	" 15-18	November 18	
Columbus	Miss.	33½	Early in April	September	
Augusta	Ga.	33½	March 25	" 1	
Denison City	Texas.	34	April 1-10	October-December	
Atlanta	Ga.	34-	" 1	"	
"	"	34-	" 1-10	" 1-10	
Fayetteville	N. C.	35	" 5	September 15	Not a success.
Hamburg	S. C.	35½	" 1-10	November	
Salisbury	N. C.	35½	" 12	September 10	
Fort Smith	Ark.	35½	" 1	November 1	
Vineyard	N. C.	35½	" 10	" -January.	
Greensboro	"	36	" 1	Midwinter	
"	"	36	" 15	December 1	
Shore	"	36	Last of March	November-March	
Raleigh	"	36-	April 1-10	October 15	
Vandalia	"	36	" 15	" -January	
Point Pleasant	Mo.	36½	" 9	" 1	
Alton	"	37	March 20-April 15	September 10-October 10	
Piedmont	"	37+	April 15	December 1	
Carthage	"	37+	" 12	Late fall and early winter	
Doniphan	"	37-	" 15	October 20	
Wellington	Ks.	37+	" 5-20	December 1	Heavy bearer on bottom lands.
Milford	Mo.	37½	" 25	" -February	
Sheldon	"	37½	" 10	January 1	
Cherryvale	Ks.	37½	" 10	October-January	
San Leandro	Cal.	37½	" 1-10	July 15-September 1	All varieties included.
Fairfield	Mo.	38	" 18	September 1	
Clinton	"	38+	" 18	December	One month later than usual.
Mulberry	"	38+	" 1-10	November-January.	Date of blooming is general for all apples.
Peabody	Ks.	38	" 20	February 20	
Barry	"	38	" 20-25	January 1	
Gasconade	Mo.	38½	" 20	November 15	
Bluffton	"	38½	" 25	" -January.	
New Albany	Ind.	38½	" 20	September 20	
Americus	Ks.	38½	" 15-25	October 20-November 1	Date of blossoming is average for all apples.

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TABLE V.—*Continued.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Emporia	Ks.	38½	April 25	January 15	
Boonville	Mo.	39	" 20-30	September 15	
New Florence	"	39	" 24		
Beaman	"	39	" 24	December and January	
Richmond	"	39+	May 1	January 1	
Harlem	"	39+	April 21	September 30	
Belpre	Ohio	39	Last of April	Early winter	
Bartle	Ind.	39	May 2	November-February	
Detroit	Ks.	39-	April 15-20	October and November	
Holton	"	39+	" 25	December 20	
Fairmount	"	39+	" 20		
Waveland	"	39	" 15	February-May	
Manhattan	"	39	" 20	October 10	
Riley Center	"	39	May 1	December 20	
Greencastle	Ind.	39½	April 25-30	October 15	
Deerfield	N. J.	39½	May 12	November 15-January 1	
Monrovia	Ks.	39½	April 25-May 10	November 1	
Invermay	"	39½	" 30		
Easton	"	39½	" 25	November 1	
Bolton	Mo.	40	" 20	February 1	
Whiteville	"	40	May 1	December 1	
Springfield	Ohio	40	" 1	" -April	
Barnesville	"	40	April 10	January 15	
New Ross	Ind.	40	" 25	" 15	
Manalapan	N. J.	40+	May 16	Winter	
Bloomingdale	Ind.	40	April 15	October 15	
St. Johns	Mo.	40½	May 6	December-April	
New Brunswick	N. J.	40½	" 10-15	October 1-15	
Indiana	Pa.	40½	" 8-15	February	
Denmark	Iowa	41	" 1	January	
La Plume	Pa	41½	" 12-20	" 10	
Erie	"	42	" 25		
Ithaca	N. Y.	42½	" 12	January	
Brockport	"	43	" 29		
Geneva	"	43-	" 14		
Rochester	"	43+	" 15	December 1	
"	"	43	" 24	February 1	
"	"	43	" 27-30		Barry's report.
Geneva	"	43	" 13	October 1	

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TABLE VI. *Limber Twig Apple.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Thomasville	Ga.	31-	March 10	Sept 20-Oct.	
Spartanburg	S. C.	33	" 29	" 5	
Denison City	Tex.	34	April 10-20	Dec. to March	
Atlanta	Ga.	34-	" 1	Sept.	
"	"	34-	" 10-15	About Nov. 1	
Fayetteville	N. C.	35	" 5		Rots before time for maturing.
Salisbury	"	35½	" 12	Sept. 10	
Lenoir	"	36	" 1	Oct. 15	
Greensboro	"	36	" 1	Dec.	
Shore	"	36	Last of March	Nov. to April	
Raleigh	"	36	April 1-10	Oct. 15	
Vandalia	"	36	" 10-15	Jan.-March	
Piedmont	Mo.	37	" 18	Nov. 20	
Doniphan	"	37	" 10	Oct. 20	
Wellington	Ks.	37+	" 5-20	Jan. 1	Bears well as far as tested.
Cherryville	"	37½	" 10	October	Best next spring.
Fairfield	Mo.	38	" 20	Sept. 1	
Gordon	Ks.	38	" 10-15		
Barry	"	38	" 20-25	March 1	
Gasconade	Mo.	38½	" 25	Jan. 15	
Clinton	"	38½-	" 20	November	
"	"	38½	" 21	Oct. 1	
Emporia	Ks.	38½	" 25	Jan. 15-20	
Boonville	Mo.	39	" 20-30	Oct. 15	
"	"	39	" 25		
Richmond	"	39+	May 1	Jan. 1	
Bartle	Ind.	39	" 2	Dec. and Jan.	
Holton	Ks.	39	April 28		
Waveland	"	39	" 15	May	
Manhattan	"	39	" 20	October 20	
Riley Center	"	39	May 5	March 15	
Bridgeton	N. J.	39½		January to March	
Monrovia	Ks.	39½	April 25-May 10	November 1	
Easton	"	39½	May 1	January to May	Not profitable here.
Bolton	Mo.	40	April 23	February 10	
Oregon	"	40	June 2-5	October	
Whiteville	"	40	May 4	January 1	
Springfield	Ohio	40	April 28-May 1	January	

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TABLE VI.—*Continued.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Barnesville	Ohio	40	April 15	March 10	
St. Johns	Mo.	40½	May 8	February to April	
Denmark	Iowa	41	" 1	January 25	
La Plume	Pa.	41½	" 10-20	February and March	
North Collins	N. Y.	42½	" 16-21	April 1	
Rochester	"	43+	" 27-30		

TABLE VII.—*Early Crawford Peach.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Thomasville	Ga.	31-	Mar. 10-15	July 20	
Americus	"	32	" 15	" 5-15	
Greenville	Ala.	32-	Feb. 15-Mar 1	June 1-Aug. 1	All varieties included in date of matu'y
Marshallville	Ga.	32½	Feb. 20	July 1-10	
La Grange	"	33	Mar. 20	" 5-15	
Spartanburg	S. C.	33	" 30	June 7	
Denison City	Tex.	34	" 10-April 1	July 5-15	
Atlanta	Ga.	34-	" 15-20	" 1-5	
"	"	34-	" 1	" 1	
Fayetteville	N. C.	35	" 20	" 15	
Salisbury	"	35½	" 20	" 15	
Hamburg	S. C.	35½	" 1-15	" 1-10	
Fort Smith	Ark.	35½	" 10-15	" 10	
Vineyard	N. C.	35½	" 1	" 10	
Lenoir	"	36	" 15-April 1	Aug. 1	
Greensboro	"	36	" 15	July 15	
Raleigh	"	36	" 25-April 5	June 25	
Vandalia	"	36	" 10-20	July 20	
Ridgeway	"	36½	" 20	" 4	
Alton	Mo.	37	" 1-30	" 4-25	
Piedmont	"	37+	April 1	Aug. 15	
Doniphan	"	37-	" 1	July 20	
Wellington	Ks.	37+	Mar. 25-April 5	" 1-10	Shy bearer.
San Leandro	Cal.	37½	April 5-10	" 20-Sept.	All varieties consid'd.
Sawyer	Ks.	37+	" 10		
Clinton	Mo.	38½	" 15	July 15-21	
"	"	38½	" 12	August 10-20	

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TABLE VII.—*Continued.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
New Albany	Ind.	38½	April 10	August 10	
Harlem	Mo.	39+	" 20	July 16	
Bartle	Ind.	39	" 16	" 30	
Detroit	Ks.	39-	" 10-20	August 10-15	
Waveland	"	39	" 1	July 15	
Green Castle	Ind.	39½	" 15	August 15	
Deerfield	N. J.	39½	" 25	" 10-15	
Monrovia	Ks.	39½	" 20-May 1	July 1-10	
Bolton	Mo.	40	" 16	" 20	
Springfield	Ohio	40	" 15	September 1	
Barnesville	"	40	" 5	August 15	
Manalapan	N. J.	40+	May 8	September 1	
New Ross	Ind.	40	April 20	" 1	
New Brunswick	N. J.	40½	" 15-May 5	August 20-Sept. 20	
La Plume	Pa.	41½	" 20-May 1	August 20-Sept. 1	
Wright's Corners	N. Y.	42½	May 10	September 10	
Portageville	"	42+	" 10-15	" 10-15	
Penn Yan	"	42+	" 15	" 10	
Ithaca	"	42	" 1	" 10	
Medina	"	43+	" 22	" 10	
Brockport	"	43	" 15	" 1-10	
Spencerport	"	43+	" 10-20	" 1	
Auburn	"	43	" 12	" 1	
Webster	"	43+	" 7	" 1	
Greece	"	43+	" 12	" 6-10	
Rochester	"	43+	" 8	August 26	
"	"	43+	" 8		
"	"	43+		September 5	
Sodus	"	43+	April 25-May 10	" 1-15	
"	"	43+	May 5-10	" 15-20	
Lyons	"	43	" 10	" 10	
Grand Rapids	Mich.	43	" 1	" 1	

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TABLE VIII.—*Late Crawford Peach.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Thomasville	Ga.	31	March 10-15	August 1	
Greenville	Ala.	32-	" 1-15	June 1- August 1	Date of maturity includes all varieties.
Americus	Ga.	32	February 15	August 1	
Marshallville	"	32½	" 15	July 15-25	
La Grange	"	33	March 25	" 25-August 5	
Atlanta	"	34-	" 1	August 1	
"	"	34-	" 20-30	" 10-15	
Denison City	Tex.	34	" 10-April 1	July 20-August 1	
Fayetteville	N. C.	35	" 20	August 10	
Vineyard	"	35½	" 1	" 25	
Fort Smith	Ark.	35½	" 10-15	" 12	
Hamburg	S. C.	35½	" 1-15	July 20-August 1	
Salisbury	N. C.	35½	" 25	August 25	
Vandalia	"	36	" 10-20	September 1-20	
Raleigh	"	36-	" 25-April 5	Aug. 25-Sept. 25	
Greensboro	"	36	" 15		
"	"	36	" 15	August 1	
Lenoir	"	36	" 15-April 1	" 15 and later.	
Ridgeway	"	36½	" 18	July 12	
Wellington	Ks.	37+	April 1-10	September 1-10	Good bearer.
Doniphan	Mo.	37-	" 10	August 15	
Piedmont	"	37+	" 1	September 1	
Alton	"	37	March 1-30	July 20-Aug. 25	
Sawyer	Ks.	37½	April 20		
Wheatland	Mo.	38	" 14		
Peabody	Ks.	38	" 1	August 4	
Gordon	"	38	" 15-20	September 9	
New Albany	Ind.	38½	" 12	August 25	
Clinton	Mo.	38½	" 12	September 10-20	
"	"	38½	" 20	August 10-30	
Waveland	Ks.	39	" 1	" 20	
Detroit	"	39-	" 10-20	September 1-5	
Bartle	Ind.	39	" 16	August 13	
Harlem	Mo.	39+	" 20		
Bridgeton	N. J.	39½		September 15	
Deerfield	"	39½	April 25	" 10-20	
New Ross	Ind.	40	" 22	October 1	
Manalapan	N. J.	40	May 3	September 15-20	
Barnesville	Ohio.	40	April 5	" 15	
Springfield	"	40	" 25	Last of September	

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TABLE VIII.—*Continued.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Bolton	Mo.	40	April 16	September 20	
Indiana	Pa.	40½	" 25	October 1	
New Brunswick	N. J.	40½	" 15-May 5	Sept. 1-Oct. 1	
La Plume	Pa.	41½	" 25, " 5	October 1	
Ithaca	N. Y.	42½	May 4	September 25	
Portageville	"	42½	" 10-15	" 20-25	
Wright's Corners	"	42½	" 12	" 24	
Grand Rapids	Mich.	43	" 8	" 15	
Lyons	N. Y.	43	" 10	" 20	
Sodus	"	43+	" 8-15	" 25-29	
"	"	43+	" 25-May 10	" 15-25	
Rochester	"	43+	" 3		
"	"	43+	" 8	September 28	
Greece	"	43+	" 12	" 22-23	
Auburn	"	43	" 12	" 20	
Spencerport	"	43+	" 15-25	" 15	
Medina	"	43+	" 5-8	" 30	

TABLE IX.—*Old Mixon Free Peach.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Thomasville	Ga.	31-	March 10-15	July 25-Aug. 10	
Americus	"	32	" 1	" 20-25	
Greenville	Ala.	32-	Feb. 15		
Marshallville		32½	" 15	July 20-25	
La Grange	"	33		" 20-25	
Denison City	ex.	34	March 10-April 1	" 10-15	
Atlanta		34-	" 15-20	Aug. 1-5	
"	"	34-	" 1	" 15	
Fayetteville	N. C.	35	" 20	July 25	
Hamburg	S. C.	35½	" 1-15	" 25-30	
Vineyard	N. C.	35½	" 1	" 25	
Fort Smith	Ark.	35½	" 10-15	August 1	
Lenoir	N. C.	36	" 15-April 1	" 25-30	
Greensboro	"	36	" 15	July 15	
Shore	"	36	" 1	Aug. 1-15	
Raleigh	"	36	" 25-April 5	" 1	
Vandalia	"	36	" 10	July 20-Aug. 1	

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TABLE IX.—*Continued.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Ridgeway	N. C.	36½	March 20	July 8	
Piedmont	Mo.	37+	April 1	Sept. 1	
Doniphan	"	37-	" 5	Aug. 1	
Wellington	Ks.	37	" 1-10	" 25-Sept. 10	One of the best.
Sawyer	"	37½+	" 20		
Clinton	Mo.	38½	" 12	Aug. 20-30	
New Albany	Ind.	38½	" 12	" 25	
Bartle	"	39	" 16	" 20	
Detroit	Ks.	39-	" 10-20	" 25-30	
Waveland	"	39	" 1	" 10	
Deerfield	N. J.	39½	" 25	" 20-Sept. 1	
Bridgeton	"	39½		Sept. 1	
Bolton	Mo.	40+	April 16		
Springfield	Ohio	40	" 25	Sept.	
Barnesville	"	40	" 6	" 1	
Manalapan	N. J.	40+	May 3	" 10-15	
New Roes	Ind.	40	April 23	" 15	
La Plume	Pa.	41½	" 25-May 10	" 1-15	
Portageville	N. Y.	42½+	May 10-15	" 10-15	
Ithaca	"	42½	" 5	" 20	
Brockport	"	43	" 12	" 5-15	
Greece	"	43+	" 12	" 10-15	
Rochester	"	43+	" 8	Oct. 8	
"	"	43+	" 5		
"	"	43+		Sept. 20	
Sodus	"	43+	April 25-May 10	" 20-Oct. 1	
Lyons	"	43	May 10	" 15	
Grand Rapids	Mich.	43	" 8	" 10	

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TABLE X.—*Lawton Blackberry.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Atlanta	Ga.	34-	April 20	Aug. 1	
Denison City	Tex.	34		June 10-20	
Fort Smith	Ark.	35½	April 25	" 18-July 3	
Hamburg	S. C.	35½	" 15-20	"	
Vandalia	N. C.	36	" 20-25	July 4-15	
Lenoir	"	36	May 1	Last of June	
Ridgeway	"	36½	April 25	June 1	
Wellington	Ks.	37	May 15-25	July 10-20	Bears well—too soft.
Doniphan	Mo.	37-	" 20	Aug. 20	
Carthage	"	37+	" 10	July 4	
Piedmont	"	37+	" 15	Aug. 1	
Cherryvale	Ks.	37½-	" 15-30	June 20-July 10	
San Leandro	Cal.	37½	April 15-20	July 15	
Peabody	Ks.	38	May 20	" 25	
Emporia	"	38½	" 20	" 15-25	
Clinton	Mo.	38½	" 1	" 15	
Manhattan	Ks.	39	" 20	Aug. 1	
Waveland	"	39	" 15	July 30	
Lawrence	"	39	" 5	" 5-25	
Holton	"	39+	" 12	" 14	
Harlem	Mo.	39+	" 1	" 15	
Boonville	"	39	" 12		
Monrovia	Ks.	39½	" 10-20	July 1-15	
Deerfield	N. J.	39½	" 28	" 20-25	
Greencastle	Ind.	39½	" 27	" 25-30	
Bloomingdale	"	40	" 20	" 10	Very liable to winter kill.
New Ross	"	40	" 25	Aug. 1	
Manalapan	N. J.	40+	June 9	July 15-25	
Barnesville	Ohio	40	April 25	" 20	
Dayton	"	40-	June 1	Aug. 1	
Springfield	"	40	May 28	Sept. 10	
Oregon	Mo.	40	June 15-20	August	
New Brunswick	N. J.	40½	May 15-25	Aug. 15-Sept. 15	
La Plume	Pa.	41½	" 15-25	" 5-15	
Ithaca	N. Y.	42½	July 5	" 25	
Grand Rapids	Mich.	43	June 15	July 15	
Geneva	N. Y.	43-	May 31	Aug. 3	
Lyons	"	43	June 10	" 10	
Sodus	"	43+	May 18-20	" 5-10	

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TABLE X.—*Continued.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Sodus	N. Y.	43+	May 10-25	Aug. 1-31	
Rochester	"	43+	June 15-18		
"	"	43+		Aug. 10	
"	"	43+	June 8	July 8	
Geneva	"	43-	May 29	" 25	Average for 3 years.
Spencerport	"	43+	June 15-25	Sept. 1	
Brockport	"	43	" 15	Aug. 10-25	

TABLE XI.—*Kittatinny Blackberry.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Augusta	Ga.	33½	April 1	May 30	
Denison City	Tex.	34	" 15-20	June 5-15	
Atlanta	Ga.	34	" 20	Aug. 1	
Fayetteville	N. C.	35	" 20	June 20	
Hamburg	S. C.	35½	" 15-20	June	
Ft. Smith	Ark.	35½	May 1	June 25-July 10	
Lenoir	N. C.	36	" 1	Last of June	
Greensboro	"	36	" 10	" " May	
Vandalia	"	36	April 20-25	July 4-15	
Point Pleasant	Mo.	36½	" 28	June 20-July 5	
Piedmont	"	37+	May 15	Aug. 1	
Carthage	"	37+	" 10	July 5	
Doniphan	"	37-	" 10	Aug. 15	
Wellington	Ks.	37+	" 15-25	July 10-20	The leading variety
Sheldon	Mo.	37½	" 5	July 1-10	
Cherryvale	Ks.	37½	" 10-25	June 15-30	
Peabody	"	38	" 20	July 18	
Barry	"	38	" 15	" 10	
Clinton	Mo.	38½-	" 10	" 4	
"	"	38½	" 1	" 5	
Americus	Ks.	38½	June 1	" 20-30	
Emporia	"	38½	May 25	" 10-15	
Beaman	Mo.	39	" 15	" 6-Aug 10	

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TABLE XI.—*Continued.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Benton	Mo.	39	May 15		
Harlem	"	39	April 30	July 15	
Detroit	Ks.	39		" 4	
Holton	"	39	May 12	" 14.	
Lawrence	"	39	April 25-May 5	" 5-Aug. 15	
Waveland	"	39	May 15	" 30	
Manhattan	"	39	" 10.	" 10	
"	"	39	June 25	" 15-20	
Riley Center	"	39	" 1	" 20	
Greencastle	Ind.	39½	May 27	" 15	
Deerfield	N. J.	39½	" 25	" 15-Aug. 10	
Monrovia	Ks.	39½	" 10-20	" 1-15	
Bolton	Mo.	40	" 20		
Oregon	"	40	June 5-10	August	
Springfield	Ohio	40	May 28	Sept. 10	
Dayton	"	40	May-June 1	Last of J'ly and Aug.	
Barnesville	"	40	April 25	July 15	
New Ross	Ind.	40	May 25	Aug. 1	
New Brunswick	N. J.	40½	" 15-25	July 25-Aug. 20	
Denmark	Iowa	41	" 25	Aug. 12	
La Plume	Pa.	41½	" 20-June 1	" 1-10	
Ithaca	N. Y.	42½	July 1	" 25	
Wright's Corners	"	42½	June 1	July 20	
Portageville	"	42½	" 10-20	Aug. 15	
Penn Yan	"	42½	" 1	" 10	
Medina	"	43+	" 15 (about)	" 1 (about)	
Brockport	"	43	" 15	" 1-15	
Spencerport	"	43	" 10-20	Sept. 1 (about)	
Geneva	"	43-	" 2	July 26	Av'ge time for 3 yrs.
Rochester	"	43+	" 8	" 6	
"	"	43+		Aug. 1	
"	"	43+	June 12-15		
Sodus	"	43+	May 10-25	Aug. 15-Sept. 15	
"	"	43+	" 15-20	" 8-15	
Geneva	"	43-	June 3	July 23	
Grand Rapids	Mich.	43	" 10	" 20	
Rochester	Minn.	44	May 15	Aug. 1	
Windom	"	44	June 1	Sept. 15	

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TABLE XII.—*Downing Strawberry.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Thomasville	Ga.	31-	January-May	February-June	
Greenville	Ala.	32-	January 1-Feb. 1	March 1-April 1	
Americus	Ga.	32	February 1-15	April	
Columbus	Miss.	33½	March 15	" 25-30	
Atlanta	Ga.	34-	April 1	May 10	
"	"	34-	" 1-10	April 25-30	
Denison City	Tex.	34	March 15	" 5-May 10	
Fayetteville	N. C.	35	April 15	May 12	
Fort Smith	Ark.	35½	" 1	" 5	
Vandalia	N. C.	36	" 1-15	" 10-20	
Raleigh	"	36-	" 1-10	" 20-30	
Greensboro	"	36	" 1	" 1	
Lenoir	"	36	" 15	" 15-20	
Point Pleasant	Mo.	36½	" 9	"	
Wellington	Ks.	37+	" 1-15	" 10-15	
Doniphan	Mo.	37-	" 5	" 1	
Cherryvale	Ks.	37½-	" 10-30	" 10-30	
Milford	Mo.	37½	"	" 10-20	
San Leandro	Cal.	37½		April 25-Sept	Sometimes 8 crops, with irrigation.
Wheatland	Mo.	38	April 20		
Barry	Ks.	38	" 25	May 15-20	
Peabody	"	38	" 25	June 4	
Mulberry	Mo.	38		" 1	
Emporia	Ks.	38½	April 30		
New Albany	Ind.	38½	" 12	May 20	
Clinton	Mo.	38½	" 18	June 20-30	
Manhattan	Ks.	39	" 28		
Waveland	"	39	" 15	May 15-20	
Holton	"	39+	" 25	" 25	
Detroit	"	39-	" 15-30	June 1	Sometimes earlier.
Belpre	Ohio.	39+		" 1-10	
Harlem	Mo.	39+	April 25	May 20	
Benton City	"	39	" 20		
Beaman	"	39	" 20	May 20	
Boonville	"	39	" 27	" 15	
Monrovia	Ks.	39½	" 20-May 1	June 10-15	
Deerfield	N. J.	39½	" 23	May 25-June 15	
Bloomingdale	Ind.	40	" 20	June 1	
New Ross	"	40	" 26	" 1	

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TABLE XII.—*Continued.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Manalapan	N. J.	40	May 15-20	June 6	
Barnesville	Ohio.	40	April 25	" 10	
Dayton	"	40	May 1-15	" 10 and July	
Springfield	"	40	" 1	" 10-15	
Bolton	Mo.	40	April 20	" 1	
New Brunswick	N. J.	40½	May 1-10	" 1-25	
La Plume	Pa.	41½	" 10-20	" 15-20	First picking.
Grand Rapids	Mich.	43	April 10	" 10	
Geneva	N. Y.	43	May 13	" 22	
Sodus	"	43+	" 15	July 1-8	
"	"	43+	April 10-May 1	June 15-25	
Rochester	"	43+	May 25-30		
"	"	43+	" 16	June 18	
Geneva	"	43-	" 21	" 17	Average for 4 years.
Auburn	"	43	" 20	" 24	
Union Springs	"	43	" 25		
Rochester	Min.	44	" 10	June 15	
Minneapolis	"	45	" 10-25	" 4-25	All varieties considered.
Menominee	Wis.	45	June 10	July 1	About 2 weeks later.

TABLE XIII.—*Wilson Strawberry.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Americus	Ga.	32	February 1-15	April	
Columbus	Miss.	33½	Feb. and March	April 15	
Atlanta	Ga.	34-	April 1-10	" 20	
"	"	34-	" 1	May 5	
Fayetteville	N. C.	35	" 10	" 7	
Hamburg	S. C.	35½	" 1-May 10	" 10-July	
Vineyard	N. C.	35½	March 1	" 15-25	
Fort Smith	Ark.	35½	April 5	" 9	
Lenoir	N. C.	36	" 15	" 10	
Greensboro	"	36	" 1	" 1	
"	"	36	" 10-15	" 15	
Raleigh	"	36-	" 1-10	" 20-30	
Vandalia	"	36	" 1-15	" 10-20	

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TABLE XIII.—*Continued.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Piedmont	Mo.	37+	April 20	May 15	
Doniphan	"	37-	" 1	April 25	
Wellington	Ks.	37+	" 5-20	May 15-20	Not much planted.
Cherryvale	"	37½	" 15-30	" 15-30	
Peabody	"	38	" 25	June 4	
Clinton	Mo.	38½-	" 15	May 15	
"	"	38½	" 15	June 20-July 5	
New Albany	Ind.	38½	" 10	May 15	
Emporia	Ks.	38½	" 28		
New Florence	Mo.	39	May 1		
Benton City	"	39	April 15		
Richmond	"	39+	" 15		
Harlem	"	39+	" 25	May 20	
Bartle	Ind.	39	" 24	" 22	
Holton	Ks.	39+	" 25	" 25	
Lawrence	"	39	" 15	" 25-June 15	
Riley Center	"	39	" 25	June 15	
Greencastle	Ind.	39½	May 5	" 5	
Deerfield	N. J.	39½	April 23	May 28-June 20	
Monrovia	Ks.	39½	" 20-30	June 10-15	
Bolton	Mo.	40	" 20	" 1	
Springfield	Ohio	40	May 1	" 10-15	
Dayton	"	40-	" 1	" 10 and July	
Barnesville	"	40	April 25	" 5	
Manalapan	N. J.	40	May 10	" 6	
New Ross	Ind.	40	April 26	" 1	
Blomingdale	"	40	" 20	" 1	
New Brunswick	N. J.	40½	May 1-10	" 1-25	
Indiana	Pa.	40½	" 1	" 10	
Denmark	Iowa	41	April 20	May 21	
La Plume	Pa.	41½	May 5-10	June 10-15	First picking.
Erie	"	42	" 25-June 10	" 10-30	
North Collins	N. Y.	42½	" 15-20	" 20-25	
Wright's Corners	"	42½	" 5	" 15	
Penn Yan	"	42½	" 5	" 20	
Ithaca	"	42½	" 5	" 15	
Janesville	Wis.	42½	" 16-26	" 30	
Spencerport	N. Y.	43+	" 10-15	" 15-30	
Auburn	"	43	" 18	" 18	

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TABLE XIII.—*Continued.*

Postoffice.	State.	Latitude.	Date of Blossoming.	Date of Maturity.	Remarks.
Geneva	N. Y.	43-	May 16	June 12	Average for four years.
Webster	"	43+	" 7	" 1	
Rochester	"	43+	" 18	" 21	
"	"	43+	" 25-30		
"	"	43+		June 13	
New Hartford	"	43	May 10	" 20	
Sodus	"	43+	April 10-30	" 10-20	
"	"	43+	May 10-20	July 5-10	
Lyons	"	43	" 12	June 15	
Geneva	"	43-	" 13	" 23	
Grand Rapids	Mich.	43	April 8	" 8	
Owatonna	Minn.	44	June 10	July 1	Usually one or two weeks earlier.
Windom	"	44	May 15	June 12	
Rochester	"	44	" 10	" 15	
Menominee	Wis.	45	June 7	July 1	Usually two weeks earlier.

No. 41.—FARM DEPARTMENT.

REPORT OF EXPERIMENT IN WARMING WATER FOR DAIRY COWS.

A test was made during the winter of 1888 for the purpose of determining how milk and butter products would be affected by warming the water drank by dairy cows.

The Holstein cow, Mae, was chosen for the test, which began January 19, 1888.

For the first month the cow was fed bran, ensilage and cornstalks. Half the amount of bran and ensilage, fed daily, was given in the morning and the remainder at night. The stalks were fed at noon.

The second month Mae was fed ensilage, bran, corn meal and ground oats, mixed; the daily ration was divided into two feeds, while hay was fed at noon.

The first week, and every alternate week during the test, water warmed to 60° F. was given the cow to drink. On the second week and alternating weeks cold water was given her.

Mae was watered at 7 A. M. and 5 P. M. every day during the test.

The temperature was taken each day at 5 A. M.

The number of pounds of food consumed, of water drank, of milk produced, and butter made are given in the following tables, also the total and average results.

Tables 1, 3, 5 and 7 record the results of weeks when warm water was drank,

Tables 2, 4, 6 and 8 the results of the weeks when cold water was given.

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TABLE 1.—*Warm Water.*

Date.	Pounds.					Butter.	Temp.
	Bran.	Ensilage.	Cornstalks.	Warm water.	Milk.		
January 19	5	50	11	143	36		8
" 20	5	50	10	53	42		0
" 21	5	50	12	78	44		-20
" 22	5	50	14	70	44		-10
" 23	5	50	13	64	45		8
" 24	5	50	12	81	45		-12
" 25	5	50	12	61	45		12
Total	35	350	84	550	301	10 lb 5 oz.	
Daily average	5	50	12	78 4-7	43		

The minus sign preceding figures in column headed "Temp." indicates degrees below zero.

TABLE 2.—*Cold Water.*

Date.	Pounds.					Butter.	Temp.
	Bran.	Ensilage.	Cornstalks.	Cold water.	Milk.		
January 26	5	50	12	50	44		6
" 27	5	50	12	58	43		5
" 28	5	50	8	50	42½		-18
" 29	5	50	7	48	40		12
" 30	5	50	7	54	41		20
" 31	5	50	10	86	38		22
February 1	5	50	11	50	40		22
Total	35	350	67	396	288½	9 lb 15 oz.	69
Daily average	5	50	9 4-7	56 4-7	41 3-14		

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TABLE 3.—*Warm Water.*

Date.	Pounds.					Butter.	Temp.
	Bran.	Ensilage.	Cornstalks.	Warm water	Milk.		
Feb. 2	5	50	10	98	39½		24
" 3	5	40	10	60	41		20
" 4	5	50	12	80	39½		24
" 5	5	49	10	72	40		22
" 6	5	50	10	80	40		6
" 7	5	50	10	73	41		22
" 8	5	50	11	78	38		4
Total	35	339	73	641	279	8 lbs. 14 oz.	
Daily average	5	48 3-7	10 3-7	91 4-7	39 6-7		

TABLE 4.—*Cold Water.*

Date.	Pounds.					Butter.	Temp.
	Bran.	Ensilage.	Cornstalks.	Cold water.	Milk.		
Feb. 9	5	50	10	42	40		-18
" 10	5	49	10	90	39½		-20
" 11	5	50	11	55	38½		-12
" 12	5	50	10	58	37½		-10
" 13	5	48	12	66	40		24
" 14	5	50	10	90	38		32
" 15	5	50	9	26	39		-12
Total	35	347	72	427	272½	7 lbs. 11 oz.	
Daily average	5	49 4-7	10 2-7	61	38 13-14		

On February 12 it thawed at noon, while on the 15th it was 0 in the shade all day.

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TABLE 5.—*Warm Water.*

Date.	Pounds.					Butter.	Temp.
	Bran, Corn meal, Oats.	Ensilage.	ay.	Warm water.	Milk.		
February 16	8	50	10	101	37	.....	0
" 17	8	50	10	54	39	.....	20
" 18	8	50	10	78	40½	.....	20
" 19	8	50	9	53	38	.....	24
" 20	8	50	10	70	50	.....	24
" 21	8	50	9	53	39½	3 lbs 7 oz.	26
" 22	8	50	11	79	38	4 lbs 11 oz.	16
Total	56	350	69	398	272	8 lbs 2 oz.	.....
Daily average	8	50	9 6-7	56 6-7	38 6-7	.....	.....

Thawed every day during the week.

TABLE 6.—*Cold Water.*

Date.	Pounds.					Butter.	Temp.
	Bran, Corn meal, Oats.	Ensilage.	Hay.	Cold water.	Milk.		
February 23	8	50	10	22	38½	.....	28
" 24	8	50	8	63	37	.....	26
" 25	8	50	8	80	37½	.....	33
" 26	8	46	7	78	38	.....	9
" 27	8	43	7	92	36½	.....	2
" 28	8	47	8	74	37½	3 lbs 3 oz.	0
" 29	8	50	9	33	37	4 lbs 9 oz.	20
Total	56	336	57	442	263	7 lbs 12 oz.	.....
Daily average	8	48	8 1-7	63½	37 3-7	.....	.....

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TABLE 7.—*Warm Water.*

Date.	Pounds.					Butter.	Temp.
	Bran, Corn meal, Oats.	Ensilage.	Hay.	Warm water.	Milk.		
March 1	8	50	8	90	38½		24
" 2	8	50	9	109	37½		30
" 3	8	50	8	65	42		18
" 4	8	50	9	75	39½		0
" 5	8	50	10	62	38½		9
" 6	8	50	10	114	39	2 lbs. 14 oz.	0
" 7	8	50	10	103	39½	4 lbs. 1 oz.	6
Total	56	350	64	618	274½	6 lbs. 15 oz.	
Daily average	8	50	9 1-7	88 2-7	39 3-14		

TABLE 8.—*Cold Water.*

Date.	Pounds.					Butter.	Temp.
	Bran, Corn meal, Oats.	Ensilage.	Hay.	Cold water.	Milk.		
March 8	8	50	10	42	42		10
" 9	8	50	11	38	29½		20
" 10	8	50	11	70	37		32
" 11	8	50	11	64	38		20
" 12	8	50	10	61	38		2
" 13	8	50	8	60	35½	3 lbs. 10 oz.	0
" 14	8	50	8	72	38	4 lbs. 12 oz.	5
Total	56	350	69	407	258	8 lbs. oz.	
Daily average	8	50	9 6-7	58 1-7	36 6-7		

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TABLE 9.—*Comparison of Results.*

From Tables 1, 3, 5 and 7, Milk and Butter produced. Total amount food and water consumed.					From Tables 2, 4, 6 and 8, lbs. of food and water consumed and Milk and Butter produced.				
Date.	Pounds.			Butter Produced.	Date.	Pounds.			Butter Produced.
	Food Consumed.	Water Drank.	Milk Produced.			Food Consumed.	Water Drank.	Milk Produced.	
Jan. 19-25.....	469	550	301	10 lbs 5 oz	Jan. 26-Feb. 1.	452	396	288½	9 lbs 15 oz.
February 2-8...	447	641	279	8 lbs 14 oz	February 9-15.	454	427	272¼	7 lbs 11 oz.
February 16-22.	475	398	272	8 lbs 2 oz	February 23-29	449	442	262	7 lbs 12 oz.
March 1-7.....	470	618	274¼	6 lbs 15 oz	March 8-14....	475	407	258	8 lbs 6 oz
Total.....	1,851	2,207	1,126¾	34 lbs 4 oz	Total.....	1,830	1,672	1,081	33 lbs 12 oz.
Weekly Av.....	462¾	551¾	281¾	8 lbs 9 oz	Weekly Av...	457½	418	270¼	8 lbs 7 oz.

A study of the tables shows that the milk and butter product was but little affected by the temperature of the water drank.

In the two last weeks of the test the balance is in favor of cold water. The amount of butter made the last week on cold water was 1 lb 7 oz. more than the preceding week when warm water was given the cow.

This holds true in no other case, there being a slight balance in favor of warm water during the entire period. The week when more butter was produced with the use of cold water, 16½ lbs less of milk was given than during the previous week when warm water was drank.

In the total results there is a balance in favor of warm water, there having been 45½ lbs more of milk produced during the entire period when warm water was given than during the time cold water was drank.

The balance in favor of warm water, in butter product, is 10 ounces.

This would indicate a greater relative gain in milk, by the use of warm water, than in butter.

Mae drank 535 lbs more of warm water than of cold.

If, as is usually conceded, the amount of water drank increases the flow of milk, the last figures favor warm water.

The results are not as pronounced in favor of warm water as was expected. The difference is so slight as scarcely to pay for warming the water.

It may be thought by some that a more appreciable difference might have been made if the period of each test had been longer; that the change from warm to cold water every week might affect considerably the flow of milk. The tables do not seem to justify this belief, for a careful study will show but little difference in the number of pounds of milk given corresponding days of the different weeks of the test.

The weather it will be noted was quite changeable, and this may and doubtless did have its effect on the flow of milk.

SAMUEL JOHNSON,
Professor of Agriculture.

MICHIGAN AGRICULTURAL COLLEGE,
October 20, 1888.

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No. 42.—VETERINARY DEPARTMENT.

EXPERIMENTAL WORK AMONG HORSES.

Having the beneficial results of oxygen as a therapeutic agent brought under my notice several times, through the writings of eminent scientists, I thought it advisable to experiment upon some of our domestic animals and try to determine if it would act as well upon them as it was reported to have done in the human family, for it was claimed by one of its advocates that the beneficial results from the use of this gas in a case of phthisis was surprising, while I have also information that it has done much good in other diseases.

After some consideration I concluded that the disease familiarly known as Heaves, in horses, would be an excellent one to test the remedy, for from my observation with regard to this disorder, it has always seemed to me that the great difficulty is for the animal to get its breath, to get oxygen as it were. Indeed I have watched animals time and again, laboring for existence in the most painful manner, and appearing at night as if they could not live till morning without relief, giving one the feeling all the time that they (the animals) were suffocating, which I believe they were to a certain extent, and this from want of oxygen. Taking this view of the disorder, the idea of supplying the gas artificially struck me with great favor, for I had thought it possible that by giving the lungs a rest to some extent, by introducing the gas into the animal economy through another channel, that the lesions in them might be repaired and the animal eventually regain its original health, for that animals do apparently recover from this disease when surrounding circumstances are favorable is not doubted, but just what those circumstances are is at present unknown. But I will not dwell upon them here, as later on I hope to show that the causes of the complaint are still wrapped in much obscurity, though the insufficient supply of oxygen to the economy seems to me, to be the chief cause of the distress so plainly exhibited by the animal. With the hope of supplying some, or as much as was necessary of the gas, I had a 20 gallon gasometer made, by Messrs. Truax & Co., of Chicago, and on the 18th of June I introduced 2 litres (about 2 quarts) of well washed oxygen into the rectum of a cream colored horse, the animal, however, became restless and would not retain it for any length of time. The following day I repeated the operation but with the same unsatisfactory results, I persevered though for some days, the animal in the meantime getting apparently used to it, would remain quiet during the operation which enabled me to increase the dose somewhat from day to day, and on the 26th of June I managed with some difficulty to get the animal to hold 8 litres, but found afterwards that I would have to reduce the dose, as much of the gas would be wasted, so brought it down again to four litres. Thinking that I might get the gas into the economy with more certainty of its retention, I purchased some of the peroxide of hydrogen, and on the 30th of June began to administer it to a black mare and a bay gelding, both affected with the heaves, but about the fourth day after I commenced to use it the animals both appeared unwell, refusing to eat in their usual manner, so with them I discontinued the use of the oxygen until they regained their former health. The cream colored horse received it from time to time until the 22d of July, when I made arrangements to give all three horses 4 litres of oxygen three

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times a day, I found after a few days that it should be given before meals, in order to get the animals to retain it for any length of time, and even then they would often eject it from the rectum immediately or soon after its introduction, a fact which somewhat discouraged me. However, after using the gas in this manner for about a week, I selected the black mare, which I considered the worst case of the three, had her hitched to a light carriage and drove her about two miles, and though she was far from being well, yet the improvement in her since she was in harness a few weeks before was very marked, notwithstanding that the weather was very hot, she trotted along without very much apparent discomfort to herself. I then tried the bay and cream but was disappointed to find that they had not made the same improvement. This circumstance brought forcibly to my mind some experiments by Dr. B. W. Richardson, F. R. S., reported in the *Chemical News* of June 7th, 1887, in which it is stated that "The experiments showed that freshly made, pure oxygen acted differently in different animals, some appearing unaffected while others became feverish." The black mare did not become feverish but she seemd to gain in vigor from day to day, until the 18th of August when she again became unwell and refused to eat, but rallied without special treatment in a few days. I attributed her indisposition at this time to the fact that the period of menstruation was somewhat prolonged. As I was getting a little encouragement from the black mare's condition I determined to continue treatment for some time longer, though the other two horses had not yet shown any evidence of improvement.

I continued to administer the gas three times a day, 4 litres at a time, until the 9th of September, when as I could not see that it was doing any good, I discontinued it, at the same time I felt that want of positive action was due to the fact that I could not get them to retain as much of the gas as I thought they required.

The impractibility of introducing oxygen gas into the rectum of horses in quantities large enough to affect them and without much waste of it seemed to me to be beyond question, but during my trial with the gas I learned some things in connection with the disease, that caused me to look upon this disorder as being of more importance to those engaged in horse traffic than I had ever done before. In the first place I learned that it attacked a larger percentage of young animals than I supposed it did; again I learned that it has no respect for breed, or even care and management in some instances, and the best horses are attacked as well as the poorer ones. I also learned, in a general sort of way, that the disease is unknown in some parts of the United States, while in some far western localities, I have been informed that horses recover from it, after being there for some time. With this information, which I may say was second-hand, as it were, I deemed it advisable to inquire further into it. So to begin with, on the 12th of September I addressed the following circular to upwards of 40 veterinarians who were practicing in the western and northwestern states and territories:

MICHIGAN EXPERIMENT STATION,
September 12, 1888.

To ————— :

SIR,—Will you be kind enough to inform me if the disease familiarly known as heaves is a common affection of horses in your locality, if it *is not*, I would ask if there is any popular reason given by horsemen or others *why it is not*.

I would further ask if horses going to your locality already affected with the disease ever make a total recovery, and if so, how long does it take before a cure is effected?

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Any other information that you may be pleased to give me concerning the peculiarities of this disorder in your locality will be gladly received, as I am trying to collect some facts in connection with it that may prove of much interest, as well as aid in experimental work, with reference to the *cause, cure* and *prevention* of the complaint.

Yours respectfully,

E. A. A. GRANGE.

In reply to this circular I received among others the following communications, besides promises from many, to inquire further into the peculiarities of the disease and report at some future time.

OMAHA, NEB., *Oct. 20, 1888.*

E. A. A. Grange, V. S., Agricultural College, Michigan:

DEAR SIR,—Yours of September received, and contents noted; would have answered your letter before this date, but have been out of town, and just returned.

Emphysema of the lungs, or heaves is not a prevalent disease in this locality, although I receive a case now and then for treatment. I have known of horses being shipped from the east, having the disease, and after two or three months' residence in this country, it will disappear entirely (this cannot be said in all cases). I have also noticed that feeding horses poor or musty hay will very often produce the disease. We feed no tame hay to horses here. Six years ago I could hardly find one case of heaves in this locality, but now I find them as described. Any further information you may require I will most willingly give.

Respectfully yours,

H. L. RAMACCIOTTI, D. V. S.

GRAND FORKS, DAKOTA, *Oct. 12, 1888.*

Prof. E. A. A. Grange, Agricultural College, Michigan:

DEAR SIR,—Yours of September 28, has been forwarded to me from Brookings. In reply I beg to say that the disease known as heaves is almost entirely unknown in Dakota, and certainly does not originate here, at least I have not seen a case of it in my practice that has not been imported from some other State or Territory. It is not an uncommon thing for animals so affected to be shipped into Dakota as a matter of experimentation, to ascertain the effect our atmosphere would have upon them when suffering from the disease. I have known of a number so introduced into the Territory, that have been meterially benefited by our high, dry atmosphere, and in many cases complete recovery has been brought about. There can be very little doubt but that our atmosphere has a very beneficial influence upon all lung troubles. This fact is recognized both in the human species as well as the domestic animals. The breeding of horses has not sufficiently advanced in our Territory to give any data in reference to heaves, or broken wind among native bred horses to be of any value to you, but from what I know of native or range bred stock this disease is comparatively rare among them.

If there is any other information on this subject that you desire, I shall be only too happy to furnish it.

Yours respectfully,

C. JNO. ALLOWAY, V. S.

DES MOINES, IOWA, *Oct. 9, 1888.*

Dr. E. A. A. Grange, Michigan Agricultural College:

DEAR SIR,—1st. Is it a common affection? It is quite common, so much so that we would not be far wrong to state that most of the hard worked horses of the lower classes here are affected. Animals that are attended to regularly as regards feeding and work I dont think are subject to it I am acquainted with a stock company's horses fed and worked by boys, and every pony and work-horse has it. I dont think it comes so much from either tame or wild hay as it does from an inferior quality and hard work. I have

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seen two acute cases in the last year, both coming from a load of very dusty tame hay. They recovered completely when the cause was removed; they only had two feeds of it and then were noticed heaving and one never stopped his cough until he was put under arsenic.

As regards coming from another locality here, I cannot answer. I have seen the cough entirely stop but condition of flanks remain the same.

Yours,

A. R. MORSE, V. S.

LOS ANGELES, CAL., *Oct. 4, 1888.*

E. A. A. Grange V. S.:

DEAR SIR,—Your favor of Sept. addressed to me at Emporia, Kansas, arrived here yesterday. With regard to your questions, I don't think I ever saw a case of heaves there and the talk was that a case of it brought from a clover or timothy country would get well if turned on the prairies. I have seen a few cases in this State, though seldom in this section, where it is dry and quite free from bogs. I saw more of it in the central coast country around Monterey Bay, where it is marshy and foggy. It is rather common in San Francisco. I saw one case of it here this summer, that came on after an attack of influenza; it has improved somewhat, however. I saw a case a few days ago that was brought down here about a year ago and one of the worst I ever saw; he seemed greatly improved but had been in the pound several days on short rations which might account for it.

It is quite commonly attributed to clover in the east, but I have never seen a case of it in an *alfalfa* country (which of course you know is a species of clover) either in this State or in Utah, where it is fed almost exclusively. If I should learn any new facts I will write them to you.

Please send me any printed matter at your disposal from your department and oblige

Yours resp'y,

R. T. WHITTLESEY, D. V. S.

ROCHESTER, MINN., *Oct. 4, 1888.*

E. A. A. Grange, V. S., Ingham County, Mich.:

DEAR SIR,—Your favor of the 20th of September at hand and contents noted; I should have answered sooner but have been very busy, and have been making further inquiries into the questions you wish answered.

I have been making the subject of heaves in this locality a special source of study for some months, as I have had several inquiries from local horsemen on this subject, for until the last few years the disease was unknown here, and now it is getting comparatively common, and the reason I am satisfied is to be found in the feeding of cultivated grasses instead of the native prairie hay, as it is a well known fact here, that horses fed entirely on native hay never have heaves, while those eating cultivated hay are often affected with the disorder. It is also well known here and repeatedly tried, that horses affected with the disorder, even very badly and brought here and fed exclusively on native hay (without any other treatment) within a year make apparently a complete recovery.

There is a weed which is quite common in the native hay of Minnesota, Dakota, and Colorado, and if possible another year I intend experimenting with it some myself, and if of any use to you, will be pleased to let you have the results of such experiments

It can be plainly seen that this disease is working west, as the farmers break up the natural meadows and sow cultivated grasses. Any other information that I can give you on this subject I shall be most happy to let you have.

Yours respectfully,

JOHN P. ANDERSON, V. S.

MONROE, WIS., *Oct. 1, 1888.*

To E. A. A. Grange, V. S., Agricultural College, Michigan:

DEAR SIR,—In reply to your communication regarding heaves I will state that it is quite common in this locality. An animal once affected never recovers, but is frequently

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benefited by proper feeding and watering previous to being driven. I should be pleased to learn the result of your investigations of this affection.

I remain

Yours very respectfully,

E. W. ROWLAND, D. V. S.

VERMILLION, DAK., *Sept. 29, 1888.*

Prof. E. A. A. Grange:

DEAR SIR,—Have just received your letter. I have been away from home for some time, so you will pardon me for not answering sooner. In regard to "heaves" we have but very little in this part of Dakota, and I think the reason is because we have the best of hay and pure air; there is no musty hay fed to speak of, in fact, our hay is of the very best quality, true it is wild, but free from dust and such like. I hear that in the neighborhood of Tyndal, Dakota, "heaves" is quite prevalent, and it is thought to be caused by the grasses drying very quickly in the fall, but as to the facts of the case I could not say. I have also heard some horsemen say that they knew of horses coming here from Iowa, affected with the disease, and completely recover, but I hardly think they will, though I do believe they will be helped to a certain extent, in fact I know they will. If I can be of any further service to you I will gladly act upon hearing from you. I am

Very truly yours,

A. MCCAPER, V. S.

ST. PAUL, MINN., *Sept. 23, 1888.*

E. A. A. Grange:

DEAR SIR,—In reply to yours of September 12, I beg to inform you that the trouble commonly called "heaves" is common here, and as I suppose you are working on the theory generally given out in the East, that wild hay cures heaves, I may as well state it is like many other ideas of those who have never visited the West, a fancy and delusion. I experimented for one year by feeding two private horses wild hay; at the end of that time they were both coughing. I tried all the usual cough remedies, old and new, but with no success, finally one of the mares developed symptoms of "heaves," which eventually became too well marked to please me, so I changed the hay diet on to "timothy," and in a very short period both the animals had ceased coughing, and the mare referred to, steadily improved until the respiration became natural. We are unsuccessful in treating "heavy coughs" while the animals are fed on wild hay, in fact I refuse to try where it is possible to have the change made. We are very successful in relieving cases that are not of too long standing. I often try horses by giving a mess of "wild hay" on one side of the stall and "tame" on the other, invariably they eat the tame hay in preference to the wild. Of course bad "tame hay" will be refused and the straw in the bedding preferred by most horses. But my conclusions are that tame hay is far more valuable for food where it can be obtained.

Yours truly,

RICHARD PRICE, V. S.

MADISON, WIS., *Sept. 27, 1887.*

Prof. E. A. A. Grange, Agricultural College Mich.:

DEAR SIR,—Your favor just received. Would say as regards heaves, it is a great deal more common now than when the country was first settled. It was almost unknown before the raising of tame hay, since then it is common whether as much so as farther east I do not know. It is not seen so much in driving horses as in the heavier ones. The liverymen feed our marsh or wild hay and it is not common, among horses that are fed on such hay. Horses that show it on tame hay, when put on marsh hay seem to recover in 6 or 8 months in most cases. It is considered by horsemen here that the disease is due to tame hay mostly, although I have seen horses fed on tame hay for years without being affected. At one time it was thought that the *rosin weed*, a plant that grows in some localities, was the cure, but I think in earlier years it was as much due to the feeding of wild hay and more grain as anything. The cases usually seen now

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are among farmers' horses that are fed largely on clover or timothy hay. As to horses brought to this locality there are very few brought in; we are raising more than we need. When the country was first settled heavy horses were often brought in and in a year or less would seem to recover, but the cases now are those that are raised here.

Any further questions in regard to this will be cheerfully answered. Hoping you will derive a benefit from what little information I can give you, I am

Respectfully yours,
C. A. WOODFORD.

STRAWBERRY POINT, IOWA, *Sept. 26, 1888.*

Prof. E. A. A. Grange:

DEAR SIR,—Yours at hand. In reply would say, while we had nothing but wild grass and hay we had no heaves; a horse brought here from the east with the disease would make an apparently total recovery in one season or less, but now having tame grasses and clover, we have a great deal of trouble. We attributed said recovery to the rosin weed which grew very plentifully among the prairie grass, but we now find that the fluid extract of this same rosin weed is of no benefit in the treatment of heaves. Horses taken from here farther west will recover, and the recovery is thought to be due to the rosin weed. I am glad to see that you are making this investigation and wait for the result. Any report you may have touching the diseases of domestic animals will be thankfully received.

Yours, etc.,
J. D. INGER, V. S.

There can be no doubt that this disease is influenced by *something* in the above localities. One tells us it is the air that cures, another that the food does it, though as to the kind of food there are differences of opinion; but I think before we will be able to settle whether it is the air or food, or both, we must know something about the causes, and in search for them through the writings of various authorities upon equine pathology, those which I here take liberty of quoting seem to me to cover all the causes which have been attributed to the disease up to the present, but the more I reflect upon this, the more I think there is a cause beyond any that has been suggested, that will yet require considerable research and careful investigation before it will be established. In Blaine's outline of the Veterinary Art, edited by Charles Steel, M. R. C., V. S., we find the disease heaves is called broken wind, and concerning which the writer says:

"The cause of broken wimd is hereditary or constitutional predisposition. A certain form of body is unquestionably favorable to its production, and it is from this circumstance that it proves hereditary. The narrow, confined chest, and the pendant belly, which mark low-bred horses and gross feeders, predispose towards the affection. It must be the subjecting horses to a long-continued unhealthy course of feeding on dry food, as chaff, bran, barley meal, &c. &c., that brings it on; as also working in mills where much dust is necessarily inhaled. It is seldom the immediate consequence of pneumonia: but frequently it results from those states of disordered respiration which succeed to it, as thick wind, chronic cough, &c. We see that it gradually steals on a horse, occupying months, and even years, with a slight occasional cough, which ripening into a state of impeded respiration, at last ends in broken wind. We see it also follow one hard gallop; and we can leave a horse well one day, and find him broken-winded the next. With these facts in our every-day experience, can we readily name any universal cause?

"There is another view of the cause of this disease, namely, that it depends upon derangement of the digestive canal; and if the irritability of the larynx favors the opinion advanced with respect to the lungs, the constant passing of flatus supports the other conjecture. Horses with broken wind will eat almost anything, which again is opposed to the conclusion that the lungs are the sole seat of the disorder. The belly is enlarged, the stomach distended, and its coats much thinned, which last-named facts

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would seem to decide the question. But the truth is, broken wind appears to be a universal derangement, and it is not one structure that suffers, but the entire body undergoes more or less alteration."

Spooner writing in 1842 says:

"The immediate cause of broken wind is obviously the circumstance of sudden exertion on a full stomach. In proportion to the indigestible nature of food is the disease likely to occur. Thus, musty and damaged hay is a very frequent cause; and this hay being frequently given to agricultural horses accounts in great measure for the disease being more frequent with them than with any others. Nimrod, the celebrated sporting writer, says the disease is extremely rare in France, where he now resides; and this he attributes to the fact of sweet straw being generally used instead of hay, particularly amonst farm-horses."

Professor Williams, of Edinburgh, says in his principles and practice of veterinary medicine: "To give my own opinion I have no hesitation in asserting that broken wind is generally due to improper food, more particularly to bad, musty, or coarse hay, containing a large quantity of woody fibre, from being allowed to become too ripe before being cut, and to a superabundant allowance of hay of any kind, with an insufficient supply of corn."

Dr. Smith, of Toronto, says: "A common cause is from riding or driving fast immediately after feeding, or drinking a large quantity of water. It is also produced by feeding on dusty clover hay; it is also a sequel of some of the diseases of the air passages, and of the chest."

Professor Law, of Cornell University, says: "That the causes of heaves are overfeeding on clover hay, chaff, cut straw and other bulky and innutrious foods. In Arabia, in Spain, and in California, where there is no long winter feeding on hay, and in our Territories where clover is not used, heaves is virtually unknown; it has advanced westward just in proportion as clover hay has been introduced as the general fodder for horses, and it has disappeared in England, and New England, in proportion as the soil has become clover sick, and as other aliment had to be supplied. The worst conditions are when a horse is left in the stable for days and weeks eating clover hay, or even imperfectly cured, dusty hay of other kinds, to the extent of thirty pounds and upwards daily, and is suddenly taken out and driven at a rapid pace. Violent exertions of any kind, and diseases of the lungs are also potent causes. It is mainly a disease of old horses, but may attack the colt of two years old. Finally horses with small chests are most liable, and thus the disease proves hereditary."

Having the influence of bad hay so often brought under my notice, and having three well marked cases of the disease to experiment upon, and learning through the writing of an experimenter in a trans-Atlantic agricultural paper of repute, that Fenugreec was an excellent remedy to counteract the evil effects of ill-gotten hay, besides having a good opinion of the medicine as a general tonic, and carminative from experience that I had previously had from its use, I thought advisable to experiment with it; so on the 10th of September I began by giving the same three horses that had been in the oxygen experiment, one ounce and a half of ground Fenugreec in their food three times a day; but after using it for ten days and not being able to notice any perceptible change in their condition, I increased the dose to three ounces three times a day. About ten days after using the increased dose, I thought I could notice considerable change for the better in the cream horse, and the black mare, while I must say the bay horse did not look as well in condition, though the difficulty in his breathing seemed considerably relieved. With these somewhat favorable signs I continued to administer the medicine with I thought some benefit, but I will here say that the weather nearly all

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the time since the beginning of the Fenugreec treatment has been favorable to the disease, which I am inclined to-day, (Oct. 29) to think has had much to do with the alleviation of the symptoms, I say this because the last few days have been comparatively warm and close, and I am sorry to find that the symptoms of the complaint are nearly if not quite as bad as ever.

For many years I have tried remedies in the treatment of this complaint, often with success for the time being, but have not yet been successful in finding anything which would give permanent relief. This with other things, as the care and management, etc., forces the thought upon me that those wonderful recoveries in the west and northwest are not due to the dry air, to alfalfa, or to the rosin weed, (*Silphium Laciniatum*) or any other aliment, but to the fact that the cause of the disease is not there, and in its discovery we have an excellent field for investigation. Should it prove to be a miasmatic or malarial substance we must then endeavour to find something that will counteract or destroy it.

E. A. A. GRANGE,
Veterinarian to the Michigan Experiment Station.

MICHIGAN AGRICULTURAL COLLEGE,
November 1, 1888.

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FARMERS' INSTITUTES.

The State Farmers' Institutes held during 1888, under the authority of the Board of Agriculture, were as follows:

South Haven, Van Buren Co., Tuesday, Wednesday and Thursday, Jan. 24, 25 and 26, attended by Professsors L. H. Bailey and A. J. Cook.

Grand Rapids, Kent Co., Thursday and Friday, Jan. 26 and 27. This institute was a forestry convention under the official authority of the Independent State Forestry Commission, which commission consists of the members of the State Board of Agriculture. It was attended by Hon. C. W. Garfield and Professor W. J. Beal, the directors of the commission, and by Professor L. H. Bailey, from the Agricultural College, and Hon. B. E. Fernow, Chief of the Forestry Division of the U. S. Dept. of Agriculture.

Owosso, Shiawassee Co., Tuesday and Wednesday, Jan. 31 and Feb. 1, attended by Professors A. J. Cook, W. J. Beal and R. C. Carpenter.

Ithaca, Gratiot Co., Thursday and Friday, Feb. 2 and 3, attended by Professors Samuel Johnson, E. A. A. Grange and R. C. Carpenter.

Harrisville, Alcona Co., Wednesday and Thursday, Feb. 8 and 9, attended by Professors W. J. Beal and L. H. Bailey.

Cassopolis, Cass Co., Monday and Tuesday, Feb. 13 and 14, attended by Professors E. A. A. Grange, R. C. Carpenter, W. F. Durand and E. J. MacEwan.

Adrian, Lenawee Co., Tuesday, Wednesday and Thursday, Feb. 14, 15 and 16. This institute was held in connection with the annual meeting of the State Dairymen's Association, and was attended by Professors Samuel Johnson, A. J. Cook, E. A. A. Grange and E. J. MacEwan.

Tecumseh, Lenawee Co., Thursday and Friday, February 16 and 17, attended by Professors E. J. MacEwan, A. J. Cook, Samuel Johnson and E. A. A. Grange.

President Edwin Willits and Secretary H. G. Reynolds attended each of the institutes.

Of the above series, four may be said to have related to agriculture in its more general aspects, or to "mixed farming," as it is called. These were the institutes at Owosso, Ithaca, Cassopolis and Tecumseh, and the articles presented will be found grouped together according to subject among the miscellaneous papers, and are indexed at the back of this volume both under the name of the author and of the subject.

The other four institutes, viz., those of South Haven, Grand Rapids, Harrisville and Adrian, each had a special theme, to which nearly all the matter presented had reference; accordingly the entire proceedings of these institutes are kept together.

THE FRUIT INSTITUTE.

Thus may the first of the special institutes, which was also the first of the whole series, properly be called. It was held at South Haven, January 24, 25 and 26. The program was as follows:

TUESDAY, JANUARY 24, 7.30 P.M.

Address of welcome, including some statistics of the lake shore fruit interests, Hon C. J. Monroe. Response by Pres. Edwin Willits.

Music.

Paper by Prof. L. H. Bailey.

The Ten Points most Essential to Success in Horticulture. Discussion.

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WEDNESDAY, JANUARY 25, 9 A.M.

Prayer.
"Keeping Up the Fertility of our Fruit Lands," M. H. Bixby, South Haven.
Discussion and questions.
Dinner in Monroe Hall.

WEDNESDAY, 1.30 P.M.

"Our Insect Pests, particularly the new ones, and questions relating to old ones answered," Prof. A. J. COOK.
"Relative Profit of Thoroughbred and Native Stock," E. B. Welch, Paw Paw.

WEDNESDAY, 7.30 P.M.

Music.
"The Agricultural College and Its Work," President Edwin Willits.
Music.
"An Ideal Variety of Fruit for Market." "The Apple," J. G. Ramsdell; "The Peach," A. S. Dyckman; "The Pear," J. Lannin; "The Plum," C. T. Bryant; "The Grape," O. Beebe; "The Strawberry," A. G. Gulley; "The Raspberry and Blackberry," F. A. Wakefield. [These to be short papers, to state in as few words as possible an ideal variety for the purpose, and to name the variety, if any, that is the nearest to it.]
"The Past Year's Experience with New Varieties." with as much discussion as the time will permit.

THURSDAY, JANUARY 26, 9 A.M.

"Marketing in Its Various Phases."
"The Fruit Exchange," A. C. Glidden, Paw Paw; W. A. Brown, Benton Harbor.

ADDRESS OF WELCOME BY SENATOR MONROE.

As the region about South Haven is so largely devoted to horticultural pursuits it seems desirable to call attention to the extent and magnitude of these growing interests of our State, especially that those who are instructors and managers of the Agricultural College might get a more comprehensive view of the importance of the pomological and horticultural interest, in order that said interest may receive from the College a larger share in its course of studies, investigations and experiments. A circle with a radius of thirty miles, having its focus near your present place of meeting includes most of the territory which has been favored for more than twenty consecutive years, except one, with annual crops of the peach and other fruits of the tenderer kinds.

The State census of 1884, the latest official report, furnishes the following comparison of fruit yield in that year for the 74 counties of the entire State and the three counties of Allegan, Van Buren and Berrien.

Fruit.	State.	Counties of Allegan, Van Buren and Berrien.	Proportion of the State Crop Raised in the three Counties.
Apples	4,092,806 bus.	462,495 bus.	1-9
Peaches	290,091 "	187,002 "	2-3
Grapes	1,550,702 lbs.	680,177 lbs.	3-5

No statistics were gathered of strawberries, blackberries, and other small fruits, but careful inquiry shows that the larger portion of these fruits exported out of the State was from these three counties.

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In order to obtain a reasonably accurate report of the crop of 1887, I made a careful personal canvass of the three counties named.

Blanks were sent to sixty-five railroad stations and lake ports: about twenty were sent a second time with personal letters, I have received fifty-three reports by mail and some eighteen or twenty personal reports while passing about these counties. The prices I give are the average of those reported taken in the case of apples and peaches from about twenty quotations.

FRUIT CROP OF 1887 IN ALLEGAN, BERRIEN AND VAN BUREN COUNTIES.

Apples—Green, 437,028 bbls. @ $1 65	$721,096 20	
Evaporated, 112,600 bus. @ 20c green, or ready for market, including package	58,024 00	
Cider, jelly, canned or otherwise preserved, 313,200 bus. @ 10c green, or ready for market with package	109,620 00	
		$888,740 20
Peaches, estimating ½ the crop as shipped in peck baskets and ⅔ in 1-5 bu.:		
1,317,462 fifth bushel baskets @ 30c	$395,238 60	
658,731 peck baskets @ 37c	243,730 47	
		638,969 07
Pears, 44,730 baskets @ 45c		20,128 50
Grapes, 208,174 baskets @ 25c		52,043 50
Plums, quinces and cherries, 3,531 baskets at 75c		2,648 25
Berries of all kinds 222,408 half bushel cases @ $1.00		222,408 00
Onions, 58,300 bushels @ 65c		37,895 00
Other vegetables, estimated at		200,000 00
Total		$2,062,832 52

The above values are given as the amounts realized at station or dock, as up to that point the money paid out for raising, harvesting, and for packages is mainly within the counties. The figures do not include the home consumption of fruit of the 23,000 families within these counties, whether used fresh, dried, canned, preserved, in apple butter, jellies or the many other forms of keeping fruit beyond its natural life.

From the most reliable information I could get, the following is the number of acres in bearing orchards, in small fruit and market gardening:

Peach	12,000
Apple	38,000
Small fruits	6,000
Commercial gardening	7,000
Total	63,000

The total area of the three counties is 1,284,655 acres; thus only about 1-20 of the whole is in fruit, and, if we leave out the orchards which bore little or no fruit, it is probably a safe estimate that the above yields came from about 40,000 acres, or 1-30 of the area of these three counties. This gives a hint of the possibilities of increasing our orchards and gardens, after making liberal allowance for land unfit for either.

It will be observed that the most money is realized from the apple. To emphasize the importance of the apple, compare it with wheat, which is regarded as the principal money crop of the farm.

The State crop report for October, 1887, places the yield of these three counties at 1,563,969 bushels. Deducting 575,000 bushels for bread and seed (five bushels to each of the 115,000 of population), we have 988,969 bushels

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for sale, which at 73 cents, the average price for the year, gives us $721,947.37, or $166,792.83 less than the apple crop.

The continuous annual crop of the peach and other tender sorts of fruits for more than a quarter of a century has demonstrated our climatic advantages. The lake furnishes a natural thoroughfare, with the most perfect refrigerating surroundings, across which these products can be taken in a night, thus making distance of little consequence; or, in other words, *we are the convenient suburbs of the cities of Chicago, Racine, Milwaukee and other ports* with their network of railroads reaching out through the West and Northwest, to hundreds of cities and villages of growing demands. And this increasing demand is occasioned not only by the doubling of populations, but through the lessening home production of tender fruits, caused in the main by the destruction of the great forests of Minnesota, Dakota and Manitoba, which have been for the Mississippi Valley in the past what the great lakes are for Michigan—the modifying barrier to Arctic cold. Fortunately for us man cannot destroy the lakes.

[It will be observed that the editorial shears have, here as elsewhere, omitted all that is merely complimentary or of temporary interest.—H. G. R.]

RESPONSE BY PRESIDENT WILLITS.

It gives me very great pleasure to visit this region so famous as a fruit producer. I have just come from Monroe. The first pear I ever ate was grown at Monroe, and the old tree is still standing, ninety feet high and twelve feet and six inches in circumference. That county was the early fruit centre of the State, but in that respect you have long since supplanted them.

I am glad that we have here a region which holds up the glory of the Michigan apple. It is a good thing to be proud of. In California they ask, isn't our fruit as good as the Michigan fruit? as though that were the type of perfection. So in New Orleans I saw piles of Michigan apples or apples that were advertised to be such. There are other fruit regions to which great attention has been attracted. It used to be Florida that everybody was crazy for. Now they have got over that craze and to-day it is California, and there is the biggest real estate boom there that you ever saw.

Everybody is selling real estate; that is more their business that orange growing. Those who are buying are buying not to grow oranges but to sell again to the new comers, the "tenderfeet."

I saw a house embowered in great white roses, an ideal home you would think, yet the owner was looking eagerly for a purchaser.

When I left the bleak and snow-capped mountains and descended into the lovely Sacramento valley, only three hours' ride, and saw the fragrant orange groves filled with the luscious fruit and heard the marvelous stories I: hought the land well worth $1,000 per acre, and felt that were I a millionaire I would pay that price for all in sight. Then after investigation I fell to $800, then to $600, then $400, then $100, and finally, after seeing them cutting down some of their groves, I came away without investing a cent.

One man sold $6,500 worth of oranges from a 13 acre orchard, $500 per acre, and through the State every agent was telling and retelling the story of that 13 acres and assuring you that you could afford to pay $5,000 per acre for such land. So we have here in Michigan great yields from small areas occasionally, but you know that it is the average that determines the values

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of lands, and just across the road from this 13 acres was a man who was cutting down his orange grove because of the insects infesting it. How many thousand dollars an acre were those insects worth?

The fact is that there as here men have to work for their living, and you will find there as well as here unsuccessful and discouraged men who are seeking to sell out. There as here there are thorns to the roses and discounts and drawbacks to every attractive picture, and as a whole I have come back to Michigan believing as strongly as ever that it is as good a State in which to earn a living as any State in the country, California and Florida not excepted.

PROF. L. H. BAILEY ON 10 ESSENTIALS TO SUCCESS IN HORTICULTURE.

I would not limit the conditions of success to ten, but can suggest 10 conditions which, if filled, will bring with them success.

The first of these conditions, I would say, is the *man*. He must be a whole, well developed man. A thinking man; a man who knows his market as well as his orchard; who can reason justly from cause to effect; who will not conclude, as a man I knew, that grasshoppers come from golden rod swellings because they both appear at the same time; or, as the Irishman who swallowed a potato bug, and then swallowed Paris green to kill the bug; or, as the man who observed that wherever his cow set her foot in the springing wheat chess came up, and straightway concluded that a brindle cow is the cause of chess. Good brains are as important as good land.

The 2d consideration is the land; not necessarily that which will grow the most, but rather that which will grow the best, the highest colored and best quality fruit.

3d. Culture. Culture is not weed-killing. I think it a kind Providence that gave us weeds to compel us to cultivate; for, weeds or no weeds, crops need culture. Good cultivation consists not so much in plowing or stirring deeply as in stirring often. This keeps the soil soft, moist and pliable.

4th. Manure and lots of it. The best is stable manure applied to the land as fast as made. Put it on the ground in the fall, leaving it either in piles or spreading in long rows. True we cannot always do this, and in such case do not compost the stable manure, but keep it level and moist in broad, low piles. It will be all the better if kept shaded. Compost is good, not for the stable manure, but for miscellaneous refuse, leaves, garden rubbish, lawn mowings, etc. A dead cow or horse buried in the compost is wholly inoffensive and makes a valuable manure. A compost pile should be forked over two or three times a year. Another good way of making a rich compost is to gather up the weeds and other waste material and throw it into the pig pen. The animals will tramp it down, and in time you have a rich manure. I knew a man who borrowed money to begin farming and determined to farm for manure rather than for money, and to day he is rich from his practice.

5th. Location. High ridges are best for fruit, not because they are wind swept as some people erroneously suppose, but because they drain the cold air down and away. Hence, *protected* elevations are the best. I would advise the planting of windbreaks on the side from which the prevailing winds come, which in this section, I believe, are from the southwest. For this purpose evergreens are not desirable, because the term windbreak means simply to break the force of the storm and not to stop it entirely. A windbreak should not be so thick as to absorb the moisture in the atmosphere. It should be planted far enough away so as not to interfere with or retard the

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growth of the young trees. I would advise the use of beech and maple trees for windbreaks.

6th. Varieties. For this it is necessary to study the market.

7th. Marketing. I never saw marketing so well done as here. I have visited many fruit regions, those supplying New York particularly, and nowhere have I seen such tasty, effective and honest packing as right here in South Haven.

8th. Pedigree as important for fruit as for horses or cattle, as it determines the color, size and quality of our products.

9th. Succession of crops, applying especially to vegetable growing. Many of those come off early so that we can put in another crop to occupy the ground, e. g., radishes, turnips, celery.

Thus our hot beds serve successive uses and we turn a good portion of our capital several times a year.

10th. Market facilities. We must adapt ourselves to the markets, for they will not adapt themselves to us. If far from our market we must grow what can be cheaply transported, what carries a good deal of value in small bulk. Horse radish is an example of such a crop and is, by the way, often a most profitable one to grow. Finally, in closing permit me to repeat that whether we make money or not on fruit depends on what we have in ourselves.

WEDNESDAY, JANUARY 24.

MARKET GARDENING AND THE MANURE SUPPLY THEREFOR.

Prof. L. H. Bailey, being invited to speak on this subject, said: Vegetable growing has the advantage of offering a great variety of annual crops, and so enabling the grower to cater to the whims of his market and change his policy as necessary. There are two or three principles which should be kept in view.

First grow those staples for which there is always a steady demand rather than those for which there is a variable demand. Of these cauliflower, if suited to our soils, is one of the best, and celery for this region is perhaps, all things considered, the most profitable. Asparagus, sweet corn and horse radish are also profitable, the latter especially so.

Horse Radish.

I will give you our plan of dealing with horse radish at the College. The roots grow as large as one's arm, with branching roots as thick as one's finger. These branches we cut into lengths and store over winter and as late as they will keep in the spring by burying them in the cellar. Plant late in May, between rows of early cabbages, potatoes, or other crop, by making holes with a dibble and dropping in the pieces of root, small end down, one piece in a place. It grows rank and must be cut down until the first crop is out of the way. Then cultivate and harvest the last thing in the fall and market at $20 to $100 per ton, the crop averaging three or four tons per acre. To gather the crop plow two furrows on each side of row and a fifth furrow under the row. Then pick up, wash and trim the roots. Those roots that are left in the

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ground can be easily picked out in the spring, when they will stick up white and prominent, and what few remain can be covered deep by plowing back furrows on them so that few will grow so as to give any trouble as a weed.

In vegetable growing it is important to consider the succession of crops, so as to insure an even distribution of labor throughout the different seasons of the year. A good succession of crops for this purpose is 1st, asparagus, then raspberries, then sweet corn, and last squashes to close the season.

Manures.

Manure is all important, and the best of all manures is barnyard manure without the barnyard, i. e., hauled immediately so as to save loss from heating and leaching. If that is impossible, then keep it covered and moist in a broad, flat pile.

All vegetable refuse, bones, ashes, leaves, etc., etc., should go into the compost heap but not on the stable manure.

Commercial fertilizers are chiefly useful to us for the early starting of young plants in hot beds, as by their means several days' time may sometimes be gained, and in early vegetable growing time is money.

Ashes are good either leached or unleached.

Clay is rarely valuable as an application to a soil even if sandy, and then only when very thoroughly broken up.

Muck is very valuable but can be illy spared from the muck bed itself, as *in place* it is an exceedingly valuable soil.

Of the green manures, rye makes one of the best, and should be turned under when it has reached a growth of about fifteen inches.

Mr. Sheffer: Heavy soils are not good for vegetable growing without a great deal of manure.

Muck is very useful as an absorbent, either in stable or compost.

Bone meal or bone flour and guano are especially valuable commercial fertilizers—the latter best for early, quick growth.

We have the advantages of cheap lands, cheap transportation to a boundless market, and a moist climate, all making celery and cauliflower desirable crops. For cauliflower the proper soil is the first essential. If planted on uplands it will fail nine times out of ten, unless set so late as to head up just before winter. But it is better to grow on low, wet soils that can be ditched and the crop headed earlier. It can be marketed as far away as Pennsylvania.

Of celery one-half the gross income will be required for the cost of growing. It must be grown on a soil having abundance of water, and the market crop be grown early.

Question: What is the best method of bleaching celery?

Mr. Stearns: For a late crop, the soil banked up about it, and for the early crop, rake a slight ridge of soil toward the celery and place a 12 inch board on edge on each side and clamp them together with No. 9 wire. The soil bleaching produces the best flavor.

Mr. W. A. Brown, of Benton Harbor: It has been supposed that our country was good for fruit and for little else, but in our neighborhood we have found great profit in vegetable growing. Our boats bring us as near to Chicago as her immediate suburbs, and on our warm, quick soils we can grow many things as early as those from southern Illinois, and ours come into market in fresher and better condition than those sent long distances in cars. There are 400 acres of nutmeg melons grown near Benton Harbor for

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the Chicago market, where, because of their fresher condition, they bring two or three times the price of those brought by cars from southern Illinois. Our melon growers sow rye in the fall on good soil and plow under in June and use commercial fertilizers, one man using a car load in order to force the melons to rapid development. The young plants are started in hot houses, and when set out Mapes' or some other fertilizer is mixed with the earth in the hill.

Question: Do you get manure from Chicago?

Mr. Brown: Some of it; unleached wood ashes particularly, but these are not always good and we are getting some from Canada in car load lots. Barnyard manure hardly pays transportation. It would be cheaper for us to get it by rail than by boat.

Mr. W. S. Charles, of Bangor, said, on being asked to give his experience in

Onion Raising.

We raise onions very successfully on drained marsh lands. These lands are originally covered with black ash, tamarack and soft maple timber, with the muck varying from 10 inches to 20 ft. in depth. It costs from $7 00 to $12.00 per acre to clear and stump the land. We drain by means of open ditches. A ditch 2 ft. deep and 4 ft. wide costs 25c per rod, and a ditch 4 ft. deep and 10 ft. wide costs $1.50 per rod.

I have raised onions for 20 years and think them a more certain crop than corn if you use new and heavy seed and new land. I once sowed some seed that was 3 years old and on 3 rows I got 3 onions. I always sow onions on new land, making them my first and second crop. After that the land is too weedy for onions and I seed to timothy or oats or plant to corn. Insects also become too troublesome by the third year.

The onion maggot and cut worms. For the former I know no remedy, and for the latter none but catching. I have caught 108 cut worms in two feet of a single onion row. For the maggot I have tried lime, salt, ashes and plaster, singly and mixed, but could see no effect.

Mr. Edgell: I have grown onions successively for 14 years on the same soil and got the best of the onion maggots by the use of salt.

Mr. Charles: The age of the land makes no difference in the proportion of scullions in the crop. Scullions come from poor seed—that I think is raised from scullions. I buy seed of Hiram Sibley and have almost no scullions. Yellow Danvers is altogether the best variety, and requires about 3 pounds of seed to the acre. I use no fertilizer, and the muck gradually wears out. Thus 50 acres that 15 years ago was four-fifths muck is now four-fifths clay wheat land, the muck having been almost entirely worn off from 30 acres of it. I give below a statement from my own experience of some

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Sample Crops from a Drained Muck Swamp.

Year.	Crop.	Area, Acres.	Yield.		Value of Crop.		Remarks.
			Per acre. Bushels.	Total. Bushels.	Per Acre.	Total.	
1886.....	Onions	6	.....	.....	$214 00	$1,285 00	Worked by two men.
1887.....	"	13	230	3,000	150 00	1,950 00	Raised by a neighbor.
"	"	4	400	1,600	.....	.....	" " "
"	Potatoes	4	425	1,700	.....	.....	" " "
"	Onions	10	200	2,000	.....	.....	
"	"	2	.....	.....	280 00	560 00	Crop cost $100, and use of land.
"	"	50	250	12,500	162 50	8,125 00	Total onion crop of neighborhood

Mr. Whitehead, of Benton Harbor: The conditions in the neighborhood of Bangor, where Mr. Charles grew his onions, were peculiar, and yet he grew onions but two years on new ground.

The finest crops of onions I have ever seen were in California and Connecticut and on salt marshes in New Jersey.

Prof. Bailey: The difficulties of onion growing increase on older land.

We grew a half acre of onions and made so good a profit that my hired man concluded that was better than $18 per month, and left me and hired land to grow onions, and this season lost all the money he had.

Mr. J. J. Woodman, of Paw Paw: Is Mr. Whitehead's idea that salt is good for onions and kills weeds, and that the practice may be kept up?

Mr. Whitehead: Yes sir.

Mr. Copley: My idea of the greatest need of onions is that it is water not salt. A weed is but a plant, and salt will not discriminate between useful and useless plants.

Mr. ———: The marsh grown onions are of ranker flavor than those grown on uplands, and the Chicago merchants say they don't keep as well.

Mr. Copley: We have plenty of buyers and they make no complaint.

Mr. Charles: I have kept them in my cellar till June, and Kimball, who bought my onions by the car load in Chicago, said they were excellent keepers and as fine as any ever sold in the city by the car load.

HOW TO KEEP OUR FRUIT LANDS FERTILE.

BY MARTIN H. BIXBEE.

[Read at the South Haven Institute, January 25, 1888.]

Mr. Chairman and Brother Farmers,—Our fruit plantations, mainly, are now occupying lands that have been many years cropped for ordinary farm produce, and with the common instinct of Michigan pioneers, their owners have done their best to extract the phosphates from the soil and place them where they will do the least good to their farms; that is in the hands of the wheat buyer, only keeping enough stock for domestic use, which may be only the family cow and a farm team or two.

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Orchards and berry plantations on newly cleared land are much better in productiveness and quality of product than those planted on old farming lands of the same natural quality which the common farming has partially unfitted for fruit growing.

Only a small share of our lands are yet planted to fruit, while the balance are mostly bearing unprofitable grain crops or some produce that is annually sold from the land and no return made, except to sometimes turn under a turf made thin by too much mowing and pasturing, each rotation bringing lighter crops until we hear much complaint of fallure to even induce grass to grow at will. Sod or turf, the wheat grower's manure, is the key to the whole situation, *but you must get a good sod*, and how to do it is sometimes quite difficult unless you feed out the produce of the farm on the farm to live stock.

Feed your produce and do not waste the manure. As to how to waste the smallest amount, my experience teaches me to remove all manure not well sheltered as fast as made if possible, if not, as soon after as possible; spread all fine manures on the surface of the meadows or oat ground after plowing, and put the coarse, including all straw not needed for bedding stock and teams, on the poorest places of the corn ground and plow it in. Keep all manures such as may be in the sheep pens or other shelter, and not likely to ferment, and such as may accumulate in the meantime, until after haying, and spread on the meadows as soon as possible after mowing the hay crop.

The straw stack is worth much more before it has been wet and rotted down, to plow in for corn or potatoes, than when treated in the usual manner.

Our berry plantations are easy to get along with, for they are not kept from grass like our well tilled orchards. The old strawberry bed will produce a good crop after the vines are plowed under, can be seeded to clover if one has no manure.

Our greatest difficulty is with the orchard that is plowed each year and given the clean cultivation that is necessary to make crops of good quality.

Such constant stirring destroys the vegetable matter in the soil, which, if heavy becomes very compact, and if light, more easily affected by drouth and penetrated by frost. To make good the loss it will be necessary, even with plenty of barnyard manure, to supply some coarse vegetable matter, the same as turf renovates in a measure the general farm.

We of this section have mostly adopted the plan of making a turf of rye, by sowing towards the end of the summer and plowing under the following May, and I shall not be contradicted when I say it has been worth many thousands of dollars to the value of our orchards during the last fifteen years, and no one abandons it except to return to its use.

Much credit is due T. T. Lyon and A. T. Linderman for the introduction of e practice here about 1873.

But he who depends upon rye alone will find after a few years that he has not given his trees what the stock grower would call a "well balanced ration."

What more may be required and how applied has been a subject of much inquiry and disagreement. Barnyard manure appears to be quite popular, but few have the courage or energy to procure it in almost the only practicable manner, and that is by feeding *purchased fodder and grain*, for it is purchasable, as in spite of all the advice that can be lavished, some will raise hay and corn to sell instead of to feed, and sell the straw stack instead of spreading it on their farms.

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They inquire what stock they can feed that the gain will pay for the outlay in feed.

In a general way we had better feed something in which we may have the least competition. If only fed for the winter and for the butcher, lambs are usually quite profitable and will make some return for your skill as well as for the feed. Plenty of such were sold around here last fall for $2.80 each that are worth now in the Chicago market over $6.00.

No class are so well fitted by habits of observation and scientific reasoning to begin the breeding and care of thoroughbred stock as trained fruit growers, and it would be well for each small fruit farm to produce some fine specimens each year of the owner's favorite kinds of well bred domestic animals, the value of which would be in great proportion due to his skill instead of to the feed, while by so doing he would avoid sending away his money for commercial fertilizer.

A word as to the application of these extra manures. I would apply on the surface when possible, either as top dressing or in the drill with the rye, or if later, mound around the tree and spread *early* in the spring and insure, if possible, a fine strong rye turf. On tolerably good land clover may be sown in the fall, and plowed under in the spring, to good advantage.

Another quite popular manure for the orchard, when it can be procured, is swamp muck, but as it is possible for only a few to get it, I will say very little of it except I believe it is valuable principally for heavy soils and its use merely mechanical, as it protects the roots in the winter and loosens up the compact soil.

Alongside of the last for light soils I would place clay as much more valuable, more particularly for the pear and peach. It has not yet come in use as a manure, but from a limited observation and slight experience I have so much confidence in its value that I shall use it on light soil orchards when I can get it at a fair outlay. Either of the above should be placed around the base of the tree in the late fall and spread before plowing in the spring.

Mr. Wilcox: Will clover and wheat raised alternately keep up quality of land, both being sold? A man from Kalamazoo said he had practiced it for 12 years with continual improvement.

Mr. Lee: In Stark Co., Ohio, they revive land by wheat and clover, cutting the clover one year and plowing it in the next.

Mr. J. J. Woodman: In European rotations it is a universal principle to never have two cereals succeed one another except in Hungary, where spring wheat follows winter, and then as a result they average 12 bu. per acre, and in England 29.

Clover we cannot do without, and clover plowed under each alternate year might enable us to grow wheat between each crop.

The value of the clover plant cannot be overestimated, and the greatest problem is, how to insure a catch.

Prof. Bailey: On some light lands in Wisconsin and New York, when they could not get a good catch they sowed salt with the clover and had a good crop. A crop of two tons of clover taken off leaves four tons of roots in the ground.

Mr. Stearns: In our nurseries where the soil was sloping I used manure on the surface in seeding with wheat as a sort of a mulch, and with even a very slight dressing secured in *every case* a perfect catch, no matter how dry the season.

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Mr. Voorheis: I would like to ask the experience of any one, in seeding in August or September.

Mr. J. J. Woodman: There is less difficulty on heavy soils than on light. To prepare ground last of August or first of September, as if for wheat and sow clover alone is the surest way. The same method in the middle of April is also pretty sure, and unless drouth prevents you can sow in spring with oats successfully. Also with rye in fall or with corn in August is good. Seeding in spring with wheat always fails with me.

Mr. N. H. Bangs: I was raised in western New York, where wheat and corn were the main crops (on a limestone land). We plowed under heavy clover each alternate year, following with wheat, and the yield did not deteriorate.

Question: How is it now?

Mr. Bangs; I don't know.

Pres. Willits: They have had to give up the system. The land got clover sick. That system is not of itself permanently sufficient.

Mr. Rood: Does Mr. Woodman harrow in his clover seed?

Mr. Woodman: Always.

Mr. Rood: I have tried both side by side and had what was harrowed fail and the other succeed.

President Willits: Did clover seed do better before it used to be hulled?

Mr. Woodman: I think not. My seed always grows, and the trouble is in keeping the plant alive after it is up, from drouth and freezing. I fully agree with President Willits that you can not continue to take alternate clover and wheat from soils without addition of fertilizers.

In Europe, many soils that have been cultivated 1,000 years are richer now than ever. Why? Because they require specific rotations (for example, wheat, roots, oats, clover mowed one or two years) and manuring once in 3 or 4 years, and they do not permit two cereals to follow in succession.

The soil is the wealth of the nation, and in exhausting it we are destroying our country.

Mr. Glidden: Mr. Rood says he sowed clover on wheat and oats the same day and dragged the oats and not the wheat, and the former failed and the latter grew. Now what grew on the land before the oats?

Mr. Rood: Corn.

Mr. Glidden: I believe that cut worms destroy much more clover seed than they are given credit for, and very likely that is the explanation in this case rather than the harrowing.

Prof. Cook: I am glad to hear what Mr. Woodman says, that clover alone can not be depended upon without manure. We don't appreciate the value and necessity of manure and must use it in connection with clover.

President Willits: You can't take three from two and have a remainder all the time. You can't keep cropping the ground year after year without returning anything to it without exhausting the fertility of the soil.

Mr. Dyckman: I have heard the statement that 90% of the plant came from the atmosphere. If so, may you not yet take 3 from 2 in dealing with the soil?

President Willits: Lawes and Gilbert deny that the clover gets much from the atmosphere.

Prof Bailey: There is no nitrogen derived by plants from air. Clover gets it from deep in the soil and brings it where it is available. It is carbon that plants get from air, not nitrogen.

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Ensilage.

Prof. Cook: Ensilage will enable us to keep a large amount of stock. I built a silo 15x15x20 feet for $126.88, put 70 tons or five acres of corn fodder in it, and have fed 20 head of cattle, 13 horses, and some sheep since December 1st, and am still a good ways from the bottom of the silo. If building again I would use lath-boards, and plaster onto it and think that would be sufficient. Have a door into the silo reaching from top to bottom, and feed from the top. Use no salt. Let the corn get mature as for cutting up ordinarily, i. e., with the kernel glazed, and cut ears and all into one inch lengths. Tread the corn-fodder down as you store it.

For large animals, horses or cattle, one bushel of ensilage per day is a good allowance. I feed ensilage in the evening, and dried corn fodder in the morning, and to milch cows, four quarts of middlings at noon.

For ensilage I plant 10 to 12 quarts of corn per acre with a drill, and cultivate with a harrow.

In harvesting, you can put the corn in as soon as it is cut without leaving it to wilt, or you can leave it several days without injury, but it should not be put in when wet from rain.

It is not necessary to put on weights, but it should be pressed down firmly around the sides and covered with paper or something to make it air tight.

Question: What is the reason that corn, when ensilaged, will support so much more stock than when dried?

Prof. Cook: The food is in a more digestible form. A man can eat three or four green apples without any trouble, but dry them and then see.

Mr. Whitehead, of Benton Harbor: Our soils are sick for want of feeding. We can afford to pay $20 per ton for bran and $1.20 per cwt. for ground feed for the production of milk, butter and manure. Beets are excellent food for cattle, mangel wurzels and the French sugar beet.

Prof. Cook: Ensilage is as good and cheaper.

Question: How exterminate Canada thistles?

Mr. Brown: Cut them every week.

Mr. Hopkins: Plow and cultivate *thoroughly* through the season so as not to let them breathe and it will kill them.

Mr. Wright: On poor soil that will do. On black bottom land I cut them off every second day from August first till winter, and it killed them almost entirely.

Mr. Bixby: I plowed them in when in blossom, and worked the land well and killed them.

Mr. Linderman: How much can a man gain by killing thistles if his neighbor lets them grow?

Prof. Bailey: Canada thistle has two kinds of seeds, fertile and infertile, and the latter are the most common, they propagate chiefly by roots.

Insect Enemies

Prof. Cook's lecture on ticks will be found in the proceedings of the Adrian Institute, and the substance of the discussion on the codling moth will be found in the Experiment Station report, later in this volume.

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Curculio.

Prof. Cook: I read that cloths saturated with carbolic acid and wound around the limbs would protect against curculio, and I killed my trees by trying it.

Mr. A. S. Dyckman: Mr. Stearns has used carbolic acid safely.

Mr. Stearns: I slack lime with water solution of carbolic acid, and find it effective against curculio. I think it drives them away and I regard the dust of the lime as more efficient than the carbolic acid. Even ashes dusted in, several times a week will be effective. I dust the lime through the trees in the morning when the dew is on and after every rain.

Use a shingle paddle to flirt the dust, and work when as little air is stirring as possible, or else keep to the windward of the trees. It does not kill the curculio but it drives them away. Use one bushel of stone lime, one teacup full of crude carbolic acid, and enough water to slack. It must be applied as soon as the blossoms begin to fall. It is no use after the insect has gone into the fruit.

Mr. Pierce: How exterminate the wire worms?

Prof. Cook: I don't know. It is an elater or snapping beetle. The worm lives three years. Peas and buckwheat are not affected, and the first crop after plowing up a sod is not apt to be injured. Hence I would recommend planting peas or buckwheat the second and third years after turning, so that the worm may die out. Fall plowing exposes them to birds, and summer follow starves them. In England the farmers bury slices of potatoes with sticks thrust through the slices and projecting above the surface of the ground. The worms gather on the potato and can thus be easily caught.

Mr. Bixby: How about a poison manure for wire worms?

Prof. Cook: I think it is useless, as is also salt.

Currant Borers.

A blue moth with a yellow band works on the currant bushes and lays its eggs in June. The borers work both ways, upward and downward; there is only one brood in a year. The remedy is to prune and burn early in the spring. An emulsion of soap and kerosene will kill them and much is gained by spraying before the bushes leave out. Potatoes should be sprayed in the same manner as orchards, with force pump off the wagon.

Mr. ———: The squash borer may be fought by putting turpentine on cotton on a stick close to ground every few feet.

Mr. ———: I use dilute ammonia around roots.

Question: Is there a difference in variety of currants as to borers?

Prof. Cook: Not that I know of. Cabbage caterpillars syringed with pyrethrum in water early are surely killed if the syringing is done forcibly. The cabbage maggot is the same as the onion maggot, and when it comes it comes to stay. I have tried several cures, but with no success. Perhaps a change of location of a half mile or so will free for some time. For climbing cut worms I can only suggest giving them something to eat cheaper than trees or grape vines. Try cutting fresh grass and sprinkling it with Paris green and spreading it over corn ground before the corn comes up.

H. J. Linderman: I think mulching vines and trees with coarse manure will protect against climbing cut worms. It retards the starting of the vines and keeps the ground cool under the mulch so that the cut worms keep away.

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WEDNESDAY EVENING, JANUARY 25.

THE FRUIT EXCHANGE.

[BY A. C. GLIDDEN, OF PAW PAW.]

The West Michigan Fruit Growers' Society have been discussing the question of a fruit exchange for the protection of Michigan fruit growers, and delegated me to bring it to your notice. My effort shall be chiefly in describing the methods of the Delaware fruit exchange. By your present plan of marketing, you are compelled to take all chances yourselves. In Delaware the fruit growers have organized themselves into an association and by it they succeed in bringing the buyers to the growers' door. They have inspectors who grade wagon loads of fruit as they are brought. It is sold at auction. The grower gets cash down and pays one cent per bushel to the seller, which goes to the exchange. The exchange becomes responsible for the character of the goods inspected, and if a grower fails they refuse his product. The buyer then takes the chances of shipping freights, etc., etc., as that is his business and he has time to attend to the matter.

In this arrangement the shippers are able to watch the market more carefully, keeping posted as to where any excess of fruit is threatened, so that on latest advices he can countermand order as to destination of a given car load.

When a wagon load is brought in the inspector examines it any way he pleases, opening or emptying one basket or all, if not satisfied before, and when satisfied, he affixes his certificate to the load and it is sold at auction on the grading of the inspector. The inspector's decision is irreversible and unappealable.

W. A. Brown, of Benton Harbor: A fruit exchange, as I understand it, is a place where growers carry their fruit and where buyers congregate to purchase. This system has been in operation one or two years at Benton Harbor and is gaining in favor all the time. By the aid of this system and shipping in car loads, growers in western New York are putting their fruit into Chicago more cheaply than we do.

The point gained thus far at Benton Harbor and St. Joseph in their "Michigan Fruit Exchange," as it is known in this vicinity, is the use of a stamp, which is placed on first grade fruit. Fruit from all sources and by whomsoever grown enters the market on even footing if it bears this stamp, and a package which proves to be different from what it is represented to be comes right home to the grower's door. The Michigan Fruit Exchange is not yet able to put an agent in Chicago with full authority to act, but we aim at this.

One thing has been done. We have obtained cars and favorable rates, so that we can ship our fruit to the far west in car loads. We have thus overcome the difficulty presented by the rough handling and expense which attends the transferring of our goods.

A southern organization, including several States, is being perfected to ship by car load lots. In Illinois they have the granger system, and in California they have an immense organization and put train loads through to Boston, New York and Chicago. They can ship nearly as cheap as we do.

C. W. Whitehead, of Benton Harbor: It was necessary to get rates from the general freight agents or trust to the express companies, and we secured

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rates to St. Paul, 500 miles, for just the same as we paid to Chicago, 60 miles, boat and cartage. We look after the collection of bills, and by coöperation we can handle all the fruit in car load lots. If for instance, the market is flat in Chicago, the president orders a car load to Milwaukee or Detroit. We receive telegraphic reports telling how the market is at all principal points and ship accordingly, and the only way to do this is to organize and act together.

THE STANDARD FOR FRUITS.

The Ideal Apple.

[BY J. G. RAMSDELL.]

My idea of an ideal apple for market is an apple nearly perfect in all its qualities, including size, flavor, color, and good keeping. The size should be above medium, the flavor should be rich, aromatic, sub acid or sweet, the color red or lively stripes of red and yellow, with solidity enough to handle well, and a hardy tree that will bear annually and not shed its leaves until frost comes. If I were to name varieties for a succession of summer, fall and winter, each one of which comes the nearest combining all of the points named, I should select the following: For summer, Sweet Bough, Red Astrachan and Duchess. For autumn, Maiden's Blush, Gravenstein and Jeffries. For winter, Baldwin, Spy, Wagener and Talman Sweet. There are several varieties superior to these in quality but that are not profitable for market on this shore.

The Ideal Peach.

[BY A. S. DYCKMAN.]

A standard of market qualities: 1, large size; 2, globular form; 3, attractive color; 4, solidity of texture; 5, firm, velvety skin; 6, excellent flavor; 7, small pit; 8, freedom from rot; 9, freedom from mildew; 10, freedom from curl leaf; 11, freedom from cracking; 12, free stone; 13, strong hold on limb; 14, prolific bearing; 15, hardness of fruit buds; 16, hardness of wood; 17, vigorous growth; 18, spreading habit; 19, early bearing; 20, non cracking of pit.

Three varieties of yellow and three of white that come nearest to this standard in the order named:

Yellow—Early Crawford or Foster, Late Crawford and Barnard.

White—Old Mixon, Mountain Rose and Hale.

There is no reference to time of ripening, nor to selection of varieties for planting. Several of these are not thoroughly hardy, none of the old varieties are perfect in all points, nor will different growers agree as to which peach combines most of the good qualities, nor indeed as to which variety will bring the most profitable returns.

There are many varieties I have not thoroughly proven that may come in to vary the above selection. Several of these varieties cannot be probably grown except in the most favorable situations.

My selection is simply by a summation of market qualities.

Question: Which variety embraces most of points named?

Mr. Dyckman: Old Mixon.

Mr. Glidden: If Old Mixon is best, why do planters refuse them?

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Mr. Dyckman: For myself if I had a suitable situation, I know of no peach that I would prefer to the Old Mixon, and yet ordinarily, I would probably recommend none of them unless perhaps the Hale or the Barnard. The rest are not hardy enough.

Mr. Ramsdell: Of late years most growers will agree with me that Old Mixon and Early Crawford are not worth the ground they stand on. I would not plant 10,000 of them if they and the land were given to me.

Mr. Hopkins: The Crawfords, Early and Late, and Old Mixon are not now planted. They plant Jacques, Rareripe, Smock, and Stump the World instead.

The Ideal Pear.

[BY JOSEPH LANNIN.]

[Mr. Lannin has gone a little aside from describing the ideal, but his descriptions of the leading pears are in general so just that I print his article in full.—EDITOR.]

There are different opinions among fruit growers as to which one of our many good varieties of pears is the ideal.

In its season, Clapp's Favorite is in my opinion superior to all other early pears because of its large size and beautiful appearance, but care must be exercised in getting the fruit. If picked from the tree too early the fruit will wilt, and if left any too long on the tree the fruit will begin to rot at the core.

Bartlett is the ideal pear, in the opinion of many, not only of fruit growers but of purchasers as well. While the Bartlett is a showy fruit, its flavor is far from being first or even second class.

Flemish Beauty, ripening two weeks later than the Bartlett, is superior to the latter in flavor, but is not generally so handsome in appearance. Some seasons the Flemish Beauty disappoints the orchardist's expectations because of its cracked, scabby, inferior appearance, being almost wholly unfit for market.

The Louise Bonne is an abundant bearer either as dwarf or standard, sells well, but the fruit is rather small and only third class in quality.

The Seckel, in quality, stands confessedly at the front of all pears grown in Michigan. But when we concede quality, we concede all that can fairly be demanded for this fine little fruit. The tree is a slow grower and when arriving at maturity is prone to overbear. If we leave the tree to its own sweet will, the fruit grows to be perhaps, as large as a hazel nut. When heavily manured, well cultivated, and thoroughly thinned, the Seckel will grow to a fair size, and a barrel of such will sell for a high price, but the price will scarcely pay for the outlay.

The Sheldon among pears, like the Worden among grapes, failed during many years to receive from fruit growers the recognition it deserves. The tree is a nice, upright, vigorous grower, hardy, and an abundant bearer. If not allowed to overbear, the fruit will grow to be as large as middlesized Baldwin apples. Indeed I have seen some specimens of this noble fruit nearly as large as the largest Baldwin, while in quality it is in the opinion of many, fully equal to the Seckel. I have 44 Sheldon trees in my orchard, and I could wish I had thrice the number. I affirm the Sheldon is one of the richest, if not the very richest of all our pears. My only objection to the Sheldon is that some specimens of the fruit are a little hard at the core.

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In the report of the Michigan State Horticultural Society for 1886, page 421, a certain fruit grower when writing on pears, pronounces the Sheldon "The noblest Roman of them all."

The D'Anjou is a large pear, highly prized in some sections of our country. I see in the "Michigan Farmer" of this week that the horticultural societies of 21 states give this pear double stars, and 13 states give it a single star. This being the case I assume that the D'Anjou must grow richer in color and higher in flavor in other sections of our country than here in Michigan. One other objection, the tree is too long in maturing. Who desires to wait twelve or fifteen years for fruit, after planting the tree, which you will be compelled to do if you plant the D'Anjou?

The Howell is a vigorous grower and bears early. The fruit is large and sells well, it being of a fairly good yellow color, but the quality is inferior.

I will now draw your attention to my "Ideal," a pear ripening with the Sheldon and Howell, and about eight days before the D'Anjou. I refer to the Bosc. The tree is of Belgian origin. It is difficult to propagate in the nursery, and the better way to raise an orchard of this variety is to graft it upon Howell or Keiffer or some other strong growing stock. The tree will begin to bear in five or six years after planting. The tree is a strong grower. The fruit when ripe is a beautiful golden color, large, pyriform, tapering into the stalk. The flesh is white, rich, in fact a ripe Bosc is, in my opinion, the most delicious of fruits. This variety of pears is not so extensively planted as some others, consequently is not so well known in the market, but where it is known it commands the highest price, higher even than Seckel or Sheldon. The Bosc has another recommendation which I must not omit to mention. It bears regularly every year after beginning, and you will have no labor to perform in thinning out the fruit, because the tree does this of itself. It will throw off its superabundance and refuse to carry only what it can honestly mature. Chas. Downing's first choice among pears is the Bosc, and had he room for only one tree it would be the Bosc.

Mr. Stearns: I move that the chairman appoint a committee of five or six to prepare a list of varieties of peaches to plant in 1,000 trees, also of apples.

Mr. Dyckman: It seems difficult for some gentlemen to understand the purpose intended in these papers. It was not to decide what was best to plant but what was nearest perfection. A list to plant for one farm will not be the list for another. The conditions of elevation of soil, of exposure and many other conditions affect the decision.

Chairman Monroe: I suggest that the committee be requested to make a recommendation for South Haven and its average conditions.

Mr. Stearns: I would suggest that the character of soil be also stated.

The Ideal Plum.

[BY C. T. BRYANT.]

The three obstacles to successful plum growing are, the curculio, premature falling of the leaves, caused by a mildew or a fungus, and the rot, similar to that which attacks the peach, cherry and other fruits, some seasons caused also by a fungus.

The first obstacle can be overcome with reasonable diligence. But I know of no prevention for the latter scourges. Consequently the ideal plum must not be subject to these drawbacks.

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I know of no variety perfectly exempt, and but three varieties sufficiently free from these evils to justify planting extensively in this section.

The Blue Damson is all right except for the smallness of the fruit.

The Union Purple being an extremely hardy, vigorous growing tree, and holding its leaves well, and the fruit being large, rich and sprightly in flavor and juicy, in color brownish purple and mottled, is about everything that could be desired, except it has the reputation of being quite liable to rot. With this exception its qualities of tree, as well as fruit, are so superior, I have risked planting freely but have had little fruit yet. It ripens in August.

Finally, the Bradshaw is the nearest approach to the ideal I know of. The tree is a very symmetrical, fair grower, but is rather tender as to freezing, foliage beautiful and large, and does its work well until the fruit and wood are fully matured. With a fair crop, properly thinned, the fruit averages the size and nearly the shape of a hen's egg, slightly flattened, and often grows much larger; color a brownish red or purple, some a little greenish or yellow on the shady side; free stone, quality excellent, though not quite so juicy and sprightly as some; skin rather thick, and it keeps well. It is one of the earliest, coming about the middle of August, and blossoms late. If it were the color of the Blue Damson, a little more sprightly in flavor, and the tree hardier, it would be about perfect. A curculio proof plum in a moderate climate, I don't look for. As it is, the Bradshaw is my "Old reliable."

A later plum, as good, and hardy in wood and foliage, would be very desirable. Who has it? Nevertheless if the choice color is blue, we should retain for variety's sake a few of the other colors, as Lombard for red, Imperial Gage or Reine Claude for green and Gen. Hand or McLaughin, with its rich blush and unsurpassed beauty and flavor, for yellow.

Don't each of you set a million Bradshaw trees next spring, for people can't eat near as many as they can of peaches, and don't risk much on them where peach trees winterkill.

The Ideal Grape.

[BY O. BEEBE.]

I am expected to present my ideal grape for market purposes, and in doing this I shall have to consider the vine. It must be healthy, vigorous, as nearly proof against the attacks of mildew and leaf blight as may be; it must adapt itself to the greatest possible diversity of climate and soil, so as to be at home over the largest area of territory; it must be a good bearer in all parts of the country. Given the above properties of vine, let us now consider the grape itself, for one moment.

The ideal market grape must be large, or at least medium, in berry and cluster, compact in form, and nicely shouldered. The market demands high coloring, as beauty sells grapes as well as all other commodities. But I would also have fine flavor as well as size and color. And the grape that combines the above qualities would be my ideal grape for market purposes.

And now for the nearest approach to the ideal. If I had written ten years ago I should have thought of but one, the Concord, but writing to-day is very different. While to-day there are more Concords marketed from this shore and more money returned to the grower for them than for all others combined; still the world moves and we must move with it, or lose our footing, so it may be well to look a little further, whether we fare better or not. The

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Worden is a seedling of the Concord, originating, I believe, in Vermont, possessing all the good qualities of vine in greater degree than the Concord, while the fruit is larger in berry and cluster, equal in color and of very much better flavor, does not crack or drop as badly and is about ten days earlier than the Concord. Of all our native grapes I prefer the Worden as a market grape. But our market is not confined to the black grape. We have very excellent market grapes, both of red and white. The Brighton among the red grape, possesses all the qualities of a market grape, size, color, quality, productiveness and adaptation to a very wide range of climate and location making it in my opinion the very best red grape for market we have. And of the white grapes we have a number of very excellent sorts, but among them at present none seems to possess so many of the requisites of a market grape as the Niagara, so I should like to suggest as best of the three colors for market the Worden, the Niagara and the Brighton.

Question: Have Wordens been marketed from here, and at what relative price?

Mr. Beebe: Yes, for four years from 7 year old vines, and I get 10c more per basket than for Concords.

Mr. Whitehead: The average Chicago commission man does not know the difference, but I found one man there and one in St. Paul who said that the Worden brought from 2c to 4c per lb. more than the Concord. I agree with the writer as to his three varieties.

Mr. Monroe: I would like to have Prof. Bailey speak on this subject.

Prof. Bailey: My idea has been pretty well brought out by Mr. Dyckman and some others, and was to have a scale of points, with a relative marking for the different points, so that we could rate the different varieties.

I should like to hear the views of some of those present on the Wild Goose, Miner and kindred plums.

Mr. Beebe: I should consign them all to the fire.

Mr. Bixby: The trouble with the Wild Goose is that the flowers do not fertilize readily, but in a case where they were set among other varieties they fruited abundantly and the fruit sold at good prices.

Prof. Bailey: I want to say of the Wild Goose that in New York it is a profitable tree and the fruit sells well in the N. Y. market.

Mr. Hopkins: They won't bear.

Mr. Brown: A few years ago they were planted by the thousand in Berrien county. They blossomed well but did not bear fruit. They have now gone with the other wild geese to a warmer climate.

Mr. Beebe: I mixed them with Lombards, Bradshaws, General Hand and others and got a world of flowers and wood but no fruit.

The Ideal Strawberry.

[A. G. GULLEY.]

An ideal strawberry for market must be of good size, from three-fourths to an inch in diameter, very firm, of a dark red color, which must not fade after being picked. The berry must adhere to the calyx and stem and the latter also adhere to the plant stem, to enable the picker to pick a portion with each berry.

The plant must be a strong grower, make runners reasonably free, bear the berries well up from the ground, and have plenty of them, and hold the size

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of the berries to the end of the season. The plant must be adapted to a variety of soils. The blossom must be perfect.

For home market or water transportation the Cumberland is the nearest to this ideal. It lacks color, is too soft and parts too freely from the hull. For long distance shipping the Wilson is preferred, but fails in size, especially the last picking, and is now in many places very liable to rust.

PRUNING.

[BY T. T. LYON, PRESIDENT OF THE STATE HORTICULTURAL SOCIETY.]

There is probably no principle better established than that all pruning is a tax upon the vitality of the tree, and is therefore to be practiced only as a matter of necessity. Mr. H. Dale Adams is unquestionably correct in the remark, "Don't trim the tree at all if you want to preserve its vitality." Pruning, however, occasionally at least, becomes a necessity, and pruning of the fruit trees may become needful for either of two purposes—to divert growth or to secure the formation of a proper head to the tree; or to check the growth and induce or hasten fructification. To secure the former result pruning must be done before any motion of sap in the spring. It is true that the cutting away of an occasional twig may be safely done at any time, since the influence is unimportant. It is however a serious matter to amputate large branches, and with proper foresight it will seldom if ever become necessary. If done it should certainly be long enough before the commencement of growth to give time for the thorough drying of the wound, as a prevention of bleeding and consequent decay. The pruning of young trees should always be done at this season for the encouragement of growth. Pruning during the growing season is never followed by increased growth, but the reverse instead. After a tree has reached the bearing age the object is to hasten fructification; but even then the better way to secure this result is to bend the branches downward, as when loaded with fruit, and confine them in this position during the growing season, when fruit may be confidently expected the ensuing year. While much of the decadence of orchards is doubtless due to bad or excessive pruning, there is abundant reason for the opinion that by far the more general cause is starvation of the soil.

PEACHES FOR MARKET.

The committee of five appointed to prepare a list of peaches most suitable to plant in the vicinity of South Haven for market, for an orchard of 1,000 trees, of well tried sorts giving a succession through the season, reported as follows:

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	J. N. Stearns, of Kalamazoo.		A. S. Dyckman, of South Haven.		M. H. Bixbee, of South Haven.	G. W. Griffin, of South Haven.	C. H. Wigglesworth, of South Haven.	Total vote.	Average vote.
	For strong soils.	For light soils.	For best location.	For less favor'ble location.					
Alexander	50	50	.....	.....	50	.....	.....	150	21
Early Rivers	.....	.....	.....	.....	50	.....	.....	50	7
Hale's Early	50	100	100	100	100	50	100	600	86
Lewis' Seedling	.....	.....	100	150	100	.....	100	450	64
Mountain Rose	50	100	100	.....	.....	50	.....	300	43
Barnard	.....	.....	.....	150	100	.....	.....	250	36
Early Crawford or Foster	.....	.....	125	.....	.....	.....	.....	125	18
Snow's Orange	100	100	.....	150	100	.....	.....	450	64
Yellow Alberge	50	50	.....	.....	.....	150	.....	250	36
Jacque's Rareripe	100	100	125	150	100	150	250	975	140
Yellow Rareripe	.....	150	.....	.....	.....	.....	.....	150	21
Old Mixon Free	.....	.....	125	.....	.....	.....	.....	125	18
Late Crawford	.....	.....	125	.....	.....	.....	.....	125	18
Switzerland	.....	.....	100	150	100	100	100	550	79
Stanley	.....	.....	.....	.....	.....	.....	100	100	14
Hill's Chili	150	.....	.....	150	100	100	.....	500	71
Golden Drop	250	200	.....	.....	100	200	250	1000	143
Smock Free	150	100	100	.....	100	200	100	750	107
Salawa	50	50	.....	.....	.....	.....	.....	100	14
Total	1000	1000	1000	1000	1000	1000	1000	7000	1000

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Apples for Market and Home.

The committee of four appointed to prepare a list of apples for an orchard in the vicinity of South Haven, giving a succession through the season and including only well tried varieties, reported as follows:

	For Home.	For Market.				
	W. A. Brown, Benton Harbor.	W. A. Brown, Benton Harbor.	L. H. Bailey, South Haven.	J. G. Ramsdell, South Haven.	T. A. Bixby, South Haven.	Total Vote for Market.
Red June	1					
Red Astrachan		1		1	1	3
Williams Favorite	1		1	1		2
Duchesse of Oldenburg		1		1	1	3
Maiden's Blush				1	1	2
Jeffries				1		1
Gravenstein				1		1
St. Lawrence	1					
Fameuse (Snow)					1	1
Fall Pippin			1			1
Shiawassee Beauty	1					
Orange Pippin		1				1
Twenty Ounce			1			1
Hubbardston Nonsuch	1	1				1
Belmont	1					
Fallawater		1				1
Mother	1					
Wagener				1	1	2
Melon	1					
Baldwin		1	1	1	1	4
Talman Sweet				1		1
Ben Davis			1			1
Stark			1	1	1	3
Red Canada			1			1
Northern Spy				1	1	2
Number of varieties	8	6	7	11	8	32

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PROCEEDINGS

OF THE

FORESTRY CONVENTION

HELD IN

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PROCEEDINGS.

The Convention was held in Hartman's Hall, and called to order by Dr. W. J. Beal at 9:30 A. M. Dr. Beal opened the meeting with the following brief remarks: "I regret exceedingly that Governor Luce, whom we had announced would preside, is not able to be with us. He takes a deep interest in the subject, and would make a most appropriate and efficient presiding officer. The time for beginning our meeting has arrived. The subject is of great importance, and there is much to be done in these two days. As to the preliminary work for the Convention I would say: we sent out over three thousand circulars and one hundred and fifty personal letters. The letters were mostly requests to prominent men to be present at the Convention and talk upon some topic or send a short communication to be read at some of the meetings. A large part of the letters went to lumbermen, a class of men whom we thought were directly interested in the subject. From these men we received only a few favorable replies, and I see only two or three of them with us now."

Dr. Beal then called upon Hon. Henry Chamberlain, a member of the Forestry Commission, to speak in its behalf. In his reply Mr. Chamberlain said he had no set speech, as he had come to listen and to learn, and had expected to hear Hon. Franklin Wells, President of the Forestry Commission, respond to this part of the program, but as that gentleman was not able to attend, he would briefly outline the organization of the Commission. "Shortly after the passage of the act by the last Legislature making the State Board of Agriculture an Independent Forestry Commission, the Board held a meeting, at which Franklin Wells was elected President; H. G. Reynolds, Secretary; Dr. W. J. Beal and Chas. W. Garfield, Directors of the Commission. Since that time the work of carrying out the plans and duties of the Commission had devolved principally upon the Directors. This Convention is the first public step in the interest of the subject, and is designed to awaken a general interest in forestry matters and to aid in gathering and disseminating information on this subject. The consideration of our forests is of much importance and interest to the people of Michigan."

The chairman then introduced Hon. N. A. Beecher, of Flushing, Genesee Co., to whom is due the credit of introducing, in the last Legislature, the bill creating an Independent Forestry Commission. He labored diligently for the passage of the bill and he is still earnestly at work in the interest of the subject.

Mr. Beecher: I modestly decline the undivided honor of being the father of the bill, but when once introduced into the House I said, "It is not *my* bill but *our* bill."

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Before giving a history of the forestry act, allow me to present a few facts that encouraged me to introduce such a measure.

It is an admitted fact that where one-fourth to one-third of the total area of timber is allowed to grow, we can raise more products of all kinds than where the country is denuded of the same. The humidity of the atmosphere, six per cent. greater in forest than in field, assists in producing rain and is more healthful. A ton of coal dug from the earth and consumed is a lost treasure, but not so in forest culture, for we can reproduce the same.

The annual waste or consumption of forest timber in one year, in the United States is, according to the last census, estimated at $700,000,000, more than double the amount of the National Bank currency.

There are 1,000 mills engaged in manufacturing lumber and shingles in Michigan, with an invested capital of $48,000,000, and the value of the annual product approximates $60,000,000. The owners of these mills employ 35,000 persons, who receive annually an aggregate of over $7,000,000. The total product of Michigan for 1886 is almost 3,000,000,000 feet; shingles 283.838,000. Senator Palmer recently estimated this product for Michigan at 5,000,000,000 feet in one year, enough, he says, "to girdle the earth with fifteen board fences, each five boards high, at the equator."

Geo. S. Frost, an extensive dealer in Michigan pine lands, says: "The whole timbered area of Michigan is 'cornered,' and will not last more than fifteen years."

The amount of timber used by railways in operation in this State for the year 1885 was 3,750,000 ties; allowing thirty-five feet to each tie, gives 131,-250,000 feet. Then comes piling, bridge timbers, etc., which will equal one-third of the above. In addition to this there are at least 1,500,000 railroad ties shipped from this State to other localities.

It needs no argument to prove the commercial value of pine and hard woods, but the cheaper woods, those that have been considered nearly worthless, are becoming valuable. Extensive pulp factories are springing up in different parts of the State and utilizing the cheaper woods, such as spruce, balsam, small Norway, jack pine and poplar. The demand for these species is increasing rapidly.

Having had some experience in cultivating fruit trees and shrubs, some twenty-five years of my life, my mind has been naturally drawn out in a direction to observe carefully the growth, development and characteristics of tree culture. Having also a faint conception of the wanton destruction of the forests of the country, for the last twenty-five or thirty years, as being destroyed by fire, used by wasteful cutting for consumption, to supply that ever ceaseless and ever increasing demand, that ever takes from the virgin forest, and never returns, I could not help being fascinated with this subject and was just a little enthusiastic. I could see forests growing upon the hillsides, in the valleys, along the streams and brooklets, with the hair-like rootlets, permeating the soil in every direction, and holding water like a sponge, to feed our springs and wells, supply our streams and rivers that float our logs and help make the water power of the State. In the meantime I learned that others were interested in this subject as well as myself. Dr. Beal, Prof. Bailey, President Willits, Senator Holbrook, Senator Monroe, Governor Luce, Chas. W. Garfield, Representative Watson, Representative Cross, Hon. Geo. M. Dewey, Dr. Palmer, of Grayling, an ex-member of the Legislature, and many others.

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Dr. Beal kindly furnished me with a goodly number of late works on Forestry from different authors in this and other countries; also gave me many valuable pointers and rendered valuable service.

L. H. Bailey, Prof. of Horticuture, gave me some valuable facts. Senator Holbrook delivered a lecture to the people of Mason, Ingham county, on Forestry, before I had the pleasure of his acquaintance. Senator Monroe had gathered valuable statistics on forestry, and had thought some of introducing a measure on that subject. But when these gentlemen found that I was specially interested in this matter they seemed rejoiced, and were ready to give me their assistance, for which I am under obligations to them all.

I had already given notice of two bills touching upon Forestry, but somehow they did not seem to quite cover the ground. Having learned that a Forestry measure had passed the Maine Legislature, I succeeded in getting a copy of the same through the courtesy of one of the members of that body. It was of some assistance.

The limit for introducing bills was near at hand. I received a letter from Dr. Beal saying that he would like to see an Independent Forestry Commission established for the State of Michigan and put into the hands of the Horticultural Society. I thought it a good scheme with one exception—better put it into the hands of the State Board of Agriculture, in which all agreed. I gave notice immediately of such a bill, as follows: To provide for an Independent Forestry Commission of the State of Michigan, and to define its duties and powers and to provide for the expenses thereof. A skeleton bill was introduced, favorably reported, and the same laid on the table. In due time this bill was perfected, and came forth full fledged, passed both branches of the Legislature, received the Governor's signature and became a law.

This Forestry measure is in good hands and just where it belongs, and yet while it is far from being perfect in answering the object sought by its most intimate friends, inasmuch as it is less comprehensive in its scope than most of us would desire, I trust it will be the entering wedge to this apparently barren and much neglected field, and that in due time we shall be able to accomplish all that is desired—an ever-perpetuating forest for an ever-perpetuating people.

He was followed by Mr. E. R. Lake, who gave a résumé of the laws found in Howell's Annotated Statutes regarding the preservation of timber.

Dr. Beal announced committees as follows:

On exhibit—Messrs. H. D. C. VanAsmus, J. T. Cobb and Prof. L. H. Bailey.

On resolutions—Hons. Henry Chamberlain, Henry Fralick and Perry Hannah.

On credentials—W. N. Cook, E. R. Lake and Emil Baur.

Hon. C. W. Garfield next read the following paper on

NUT BEARING TREES,

[BY PROF. JAMES SATTERLEE, LANSING, MICH.]

There has been more harm done than good by enthusiastic nurserymen and agricultural editors in calling attention to, and repeating statements concerning, the enormous profits accruing from the planting of certain nut-bearing trees.

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The actual growth of some single specimen, in the most favored location, in the richest alluvial soil, is taken as the standard from which to figure the growth of one hundred trees on an acre of ordinary farming land. Taking such an isolated tree as the standard, it is not difficult to figure out an enormous profit to the planter of such tree. Nurserymen engaged in propagating nut-bearing trees repeat the statistics that have been made in this way, and paint in glowing colors the profits that are sure to come in the course of a few years.

Wise planters will not be deceived by such figures. It is safer to estimate from the average growth of a large number of these trees by the roadside, in fields, and in forests, than to be guided by the growth of a single isolated tree under exceptionally favored conditions.

In an orchard in Montcalm county of one hundred chestnut, walnut and butternut trees, planted twenty-five years ago, from twenty-five to forty feet apart, on ordinary sandy loam "oak openings" soil, the trees now average from nine to twelve inches in diameter below the branches, have handsome symmetrical heads, and are from thirty to forty feet in hight. One, a walnut at one corner of the field, in the richest, moistest soil, has reached a diameter of fifteen inches below the branches, which spring from the trunk at about five feet from the ground. These trees were kept well cultivated for the first twelve or fifteen years, since which time they have been kept in grass, and closely pastured by sheep. The trees increase in productiveness each year, and now bear ten or fifteen dollars' worth of nuts each year.

But counted from a money standpoint, this little orchard has been a failure. As a timber supply it would not be a success. The potatoes that were raised on an equal area of land by the side of this little orchard during the past year would buy more stovewood than the whole plantation would make to-day.

But happily its value does not depend on the amount of stovewood it would make now, or the amount of sawing timber it will make some time in the distant future. It has paid a good interest on the use of the land every year since it was planted, by its adding one more attraction to the old home place. We have watched its growth from the first, enjoyed the first nuts when the trees were eight years old, and enjoy the increasing supply as the trees grow older. We enjoy the blossoming of the trees and the setting of the fruit, and study the various shapes and sizes of the nuts as they drop to the ground in the glorious October days. We never tire of the bright green masses of the chestnut foliage in summer, nor of their clean and shining branches in winter.

I would not recommend, however, the giving up of productive farm land for the planting of such trees in the hope of realizing a profit. But along the roadside or near the house, or as a part of the home orchard they are worthy of a place. They add much to the beauty of the landscape, and to the attractiveness of the home.

Mr. Chamberlain: Let us do tree-planting on business principles.

Geo. Taylor: Good, and this planting of nut-bearing trees is a fine starter.

Emil Baur: In Germany the roadsides are lined for miles and miles with English walnut trees. They occupy what would otherwise be waste land and from them comes a goodly revenue. The nuts are chiefly used for oil which fills a similar place there that lard does here.

Benj. Hathaway: Trees cannot be planted for nuts or lumber *alone*. They must be planted for *all* the good properties they have.

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Dr. Beal: I find that the acorns of individual oaks differ very much in size, shape and quality. I believe by selection of seeds, in a few generations, we could materially improve the size and quality of the nuts on our trees.

Mr. Hathaway: I have observed the same thing in walnuts. While the nuts from some trees are small and almost valueless others from trees so near by that their branches would interlock are just the opposite.

Dr. Beal next read the following:

STATISTICS IN REFERENCE TO THE PINE YET REMAINING.

[BY G. W. HOTCHKISS, SECRETARY OF THE LUMBERMAN'S EXCHANGE, CHICAGO, ILLINOIS.]

"White and red pine in Forestry is like the Indian in the body politic—mostly a thing of the past. The great bulk is already gone. It has mainly gone from Maine, New Hampshire, New York and Pennsylvania. Michigan originally had about 150,000,000,000 of feet, board measure, of pine, but now has only from 12,000,000,000 to 20,000,000,000. During the last five years there has been an average cut of 4,500,000,000. Wisconsin now has more pine than Michigan, 30,000,000,000 to 35,000,000,000; Minnesota now has about 10,000,000,000. Canada is not given."

Arthur Hill, of Saginaw, followed with a statement that he thought the estimate was too low. It should be thirty billions for Michigan. "We cut closer than we used to and our standing pine is all the time growing."

Hon. Perry Hannah:—We exaggerate Nature's supplies in our estimates. The growth of hard-wood in the Traverse region is simply enormous. The great struggle there is to get it out of the way. The hard-wood in Northern Michigan is worth more to-day than all the pine Michigan has ever produced, and it would be better for our State had she never grown a stick of pine. The hard-wood is owned quite generally by small land holders and a mill owner does not need to own a large tract, as in the case of pine, in order to keep his mills going steadily.

Hon. C. W. Garfield then read a paper on

GLEANINGS FROM THE CENSUS.

[BY E. W. BARBER, JACKSON.]

"Some facts from the forest census" are wanted. There are many of them, but the census is almost barren of deductions. Like the letters of the alphabet these facts are valuable. Without the letters words can not be formed, sentences made, nor much more than animal ideas communicated. The census is a mass of facts concerning forest trees, with but little about Forestry—containing a great deal about the destruction of trees and the manufacture of lumber, and almost nothing as to their preservation. Cutting trees to save them and to preserve the forests has not been practised in this country.

"Michigan," we learn, "once possessed a tree covering of great density, richness and variety. The hard-wood forests of the Ohio valley covered the southern portion of the State, extending to just north of the forty-third latitude. North of this hard-wood belt the character of the forest changed;

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the white pine appeared, occupying the drier and more gravelly ridges, and gradually increasing in size and frequency, became the most important element in the forests of the central and western portions of the southern peninsula. In the northern peninsula, especially in the basin of the Menominee river, it covered the sandy plains to the exclusion of other species. The forests of hard-wood, occupying low, rich soil between the pine-covered ridges, were valuable in their stores of sugar maple, birch, ash, beech, oak and other northern trees, while the swamps common in the northern part of the State, abounded in tamarack and yellow cedar of large size and excellent variety."

The census maker thinks that our sandy plains, stretching from Saginaw bay northwest to the Traverse region, the acreage of which is very large, barren of valuable timber, supporting only a stunted growth, may owe their existence "to the continual burning of the forest, prostrated, possibly, in the first instance, by tornadoes, and thus affording abundant material for a fire hot enough to consume the vegetable mold of the surface, and render the soil unfit to produce a second growth of timber, or in many instances any tree growth whatever."

This, if a correct hypothesis, and there are many known facts that substantiate it, is a warning agains tree destruction. Wherever the earth has been denuded of its forests, except in very humid regions, and the soil exhausted by man, desolation has come—once gloriously fertile areas becoming arid wastes—and the intenser the summer heat the more complete the desolation. This is painfully true of the fairest portions of Asia, the birth-regions of civilization, of literature, of law, of art, of religion. Persia, Asia Minor, northern Africa, the Mediterranean States of Europe, lost their primacy, in so far as natural causes are concerned, mainly through the destruction of their forests, whereby the soil was rendered unable to sustain the needs of progressive people. As Dr. Felix L. Oswald states, "since the beginning of the sixteenth century the population of the four Mediterranean peninsulas has decreased more than 55,900,000, and the value of their agricultural products by at least sixty per cent." And in this region where forests were more essential as a protective influence from excessive summer heats than in other portions of Europe, he attributes the marked decline to their destruction.

The benefits of forests are apparent to those who will read and think. They obstruct blasting winds, they modify summer's heat and winter's cold, affording protection to man, animal and plant. They retard evaporation, absorb the water of falling rains and melting snows, feed the springs slowly, and thus maintain a constancy of the brooks that add to the value of meadows and pastures. We know, from experience, that when the forests are gone, especially those at the sources of the great rivers, violent floods are more frequent and destructive, and a great deal more property is ruined than was made by cutting away the timber. Even in a comparatively level country like the most of Michigan the water rises higher in times of flood than it did years ago. Recent experience at Lyons verifies the statement, and the authorities of Vermontville have been compelled to replace their bridges over the Thornapple, and to raise them two or three feet higher than the old ones. And, with the disappearance of the forests, not only are the winter winds more severe, but the summer heats are more intense, rendering it more difficult to grow grains and grasses, fruits and vegetables.

It does not need the census to inform us that serious inroads have already

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been made upon the forests of Michigan. Fires have been destructive; but the ax, at the beginning a useful implement, has become, except when used to save timber, one of the worst enemies of the people; and, as the cap sheaf of stupidity, we have been so prodigal of the bounties and benefits of nature that we have deemed it wise to stimulate their destruction—seemingly more anxious to produce a crop of millionaires, from hastening tree destruction, than to conserve the true interests of the State as a future home for millions of prosperous people.

Our hard-wood forests covered that portion of Michigan most noted for the fertility of its soil and the adaptability to general and profitable agriculture. "The hard-wood," says the census, "has been gradually cleared from the southern counties, now largely occupied by farms, and the timber remaining in this part of the State in small, scattering bodies, can hardly suffice for the wants of its agricultural population."

Fifty years ago this was a new country, its settlement barely begun; now it is old, its woodlands sparse and scattering, and the duty presses upon this generation to engage at once in the work of preservation and restoration, for the lungs of nature are well nigh exhausted, having been wastefully impaired.

The data for ascertaining the relative farm and forest areas, by counties, are given in the census tables. They also indicate the amount of land not included in farms. Of all the States Ohio has the least unoccupied land for agricultural purposes. Of the 26,086,400 acres comprising its superficial area, 24,529,226 acres were in farms, of which 5,982,507, or 24 per cent, were woodlands. Of the 36,755,200 acres representing the superficial area of Michigan, but 13,807,240 acres were in farms, of which 4,452,206 acres, or 32 per cent, were woodlands.

In southern Michigan, that part of the State originally covered with hard-wood forests, the lands are more completely included in farms than in Ohio. The percentage of forests to cleared areas, in 1880, is worth ascertaining and presenting. At the present time the percentage is less than it was eight years ago. The action of monopolies and combinations in arbitrarily advancing the price of coal for fuel has led to an increased consumption of wood, and the requirements of railroads for the best and thriftiest timber for crossties are enormous. The ordinary demands for wood and timber are so great as to rapidly deplete the surviving remnants of our once rich, dense and varied forest possessions.

Naming the southern counties of the State alphabetically for convenience I find that the percentage of acres in woodland to the number of acres in, farms was, in 1880, as follows:

Counties.	Per cent.	Counties.	Per cent.
Allegan	28	Kent	28
Barry	29	Lapeer	29
Branch	22	Lenawee	21
Berrien	28	Livingston	23
Calhoun	18	Macomb	22
Clinton	25	Monroe	29
Cass	24	Oakland	21
Eaton	27	Ottawa	31
Genesee	28	St. Joseph	19
Hillsdale	22	St. Clair	26
Ingham	25	Van Buren	28
Ionia	24	Washtenaw	18
Jackson	17	Wayne	21
Kalamazoo	17		

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These counties, except about one-half of those in the northern tier, lie south of the forty-third degree of latitude, and it will be seen at a glance how efficiently their forests have been removed. Competent authorities state that, for the best agricultural results in a country where the average rain-fall is even more than it is in Michigan, at least one-third of the farm lands should be covered with trees; and yet, of the counties named, in some of which there was originally considerable pine, Ottawa only showed 31 per cent eight years ago; while Jackson and Kalamazoo had but 17 per cent.

No one can doubt the value of forest protection in a climate like ours, and no christian farmer should depend upon his neighbor's woods to protect his wheat field from being blown bare of sheltering snow in winter, or to shield his corn field from the scorching and blighting winds of a dry and hot summer.

In this connection let me relate an instance that came under my personal observation last year. A tenant farmer planted eight to ten acres of corn on excellent land, which was well prepared and the crop was thoroughly cultivated. The fore part of July it looked fine and the remark was made, "There's no better piece of corn in the county." To the west and southwest for three to four miles was a stretch of country without forest or grove. During the drouth that field of corn had no protection from the full effect of the overheated air currents that came from the southwest. The inevitable result was realized. That piece of corn was literally burned up, not a bushel was harvested and the labor expended upon it was wasted. The lesson alone remained In looking for the cause of this worst-victimized corn field in the vicinity, I became convinced that it existed in the exposure to the heated air from the southwest; for a quarter of a mile east was a piece of woods, and the corn fields east of it, though not on as good land and receiving no better care, produced fair crops. The conclusion was irresistible that had there been a strip of woods on the west of the blighted field, giving it such protection from the drouth as trees alone afford, a yield of forty bushels per acre at least would have been realized. All that was needed to make the difference between no corn and 400 bushels, in this instance, was the guardianship of one of "God's first temples."

Other facts than those already mentioned, might be gathered from the forest census. There is a huge list of heathenish names of forest trees, of learned length and foreign sound, all of which a Forestry Commission should forever banish from its nomenclature, by always calling trees by their popular names. Botany is made stupid by going to the dead past for names of weeds and flowers and trees. Popularize the work now begun by calling trees trees; always write of them and speak of them by their common name; never in the barbarous jargon of the dead.

It is true that men need knowledge—intimate, accurate knowledge—of nature, but in their own language, which is the natural vehicle for their ideas. And, it seems to me, that men who follow agriculture, horticulture or other pursuit that brings them into close relations with nature, require more accurate knowledge to achieve success than in any other profession or industry. The agriculturist, more than the politician, needs to keep his "ear to the ground." In the laboratory of nature are wonder-working processes, which, to the ignorant, are miracles, but, to the wise, are sciences well worthy of diligent pursuit.

The aim of society should not be the aggrandizement of a few, but the wel-

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fare of all. There is land and water, facilities for procuring food and shelter, opportunities for a higher and better culture, enough for all, if the forces of nature are properly adjusted and applied. The face of the earth is a beautiful and useful combination of mountains and valleys, forests and prairies, lakes and rivers. Upon the soil the welfare of society primarily depends. All the culture of the schools cannot save a people from the deterioration that comes from an impoverished soil. Population will decline as the means of support diminish. For permanence and progress civilization rests upon the capability of the soil to sustain human life. Hence the study of nature is the best work in which one can engage. The organization of the Forestry Commission is a move in the right direction. The Agricultural College may be made, perhaps is already, the most valuable educational institution we have, but it should be kept true to its name. The relation between forest and production is one of the things well worth knowing. We cannot rob nature in any respect without suffering a terrible penalty. The law of compensation runs through everything. Nature makes no mistakes. Cause and consequence are inevitable. Her demands must be heeded or the race must suffer. Du Bois Raymond, I think it was, asked the question, "What would you think of a man in throwing dice who threw sixes every time?" You would say, "the dice were loaded." Well, nature always throws sixes. She never makes a mistake. Her dice are always loaded. In other words, her laws are inexorable, whether they relate to forests, or fertility, or cultivation, or production; and, to learn her laws and obey them, is worthy of the most persistent human endeavor. Civilization, progress, the welfare of the millions yet to be, require of us and of our successors that those laws shall be understood and obeyed. If they are not, if we and our successors prove to be witless enemies of nature, our country will become as desolate as the fallen empires of the east, and poverty and squalor will attest the fact that we and they were too ignorant and indifferent to be placed in charge of a land possessing such great possibilities. We can rob each other and injure only ourselves but we cannot rob nature without entailing misery upon future generations. Study nature, then, above everything else—her hills and valleys, her mountains, plains, her lakes and rivers, her fields and forests, her grains and vegetables, her fruits and flowers—protect her as you would protect your children from disaster—and learn, as only the diligent student can, something in detail of her beneficent yet inexorable laws.

Mr. W. W. Johnson: Do we have higher water now than we used to fifty years ago?

Mr. Baur: We had floods then, but they were not so destructive as now. There is not so much timber on the river banks to hold the soil now as there was then and the result is the soil is rapidly washed into the rivers, high water and floods following as a consequence.

Mr. Hannah: A. W. Slayton tells me the rainfall in the Traverse region has been on the increase in the past fifteen years. The locality, however, has much to do with this.

A. W. Slayton: Forty years ago we had just as large rainfalls in this section as we have now, but high water was not so sudden. The flood at Lyons last season was the indirect result of the rapid flow from the denuded land.

The great floods on the Ohio, a few years ago, were greater than at any time during the previous eighty years. Twenty-five years ago, Colorado needed irrigation in order to grow any kind of a crop. Now there is com-

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paratively no such need. Trees have been planted in great tracts in the West and this is one of the results.

Mr. ———: The increase of the rainfall in the Traverse region might in part be traced to these new timber belts in the West.

Mr. Coffinbury: It is the history of all rivers, where the timber has been removed, that there is a quicker rise and a quicker fall and the extremes are further apart.

Dr. Kedzie: Cincinnati had an early flood as large as the late one spoken of.

Dr. Beal: Does tile draining materially affect the flow of rivers?

Mr. ———: I think it does. Along many of our rivers the land for miles back, in some sections, is tiled. The result of this is that where water once remained for months after a rain it now only remains for hours. This certainly must have a decided effect on the rise of streams after rains or when the snow melts in spring.

S. C. Pettit: The late Jno. Johnson, of Seneca, New York, drained a large tract of land in the township between Seneca and Seneca Lake. Before draining, the land was nearly useless, as water stood on it a good share of the year. After draining, it became the most productive land in that section. The water after a rain passed quickly away, leaving the soil moist and porous. The land is a heavy loam with clay subsoil. The tile, first put in fifty years ago, were laid three feet deep. They did not work to Mr. Johnson's satisfaction, so he had them taken up and laid two feet lower. This gave the results he had anticipated and, although the neighbors at the time laughed at "Johnson's blind ditches," they soon began to acknowledge the wisdom of the scheme, and now it is the universal practice to thoroughly drain in this section. These tile are still doing good work.

S. L. Fuller: If I must stop tiling I'm going to stop farming. I don't see the use of trees in this connection. Leaves! there is no need of them for a farmer as far as crops are concerned. Manure is the thing. Enough of that and forests are useless. I have yet to hear of an argument that has any weight from a financial standpoint, and money is what we are farming for. There is too much *sentiment*. I see no relation between forestry and farming.

W. N. Cook: Much of the damage done by floods in later years is due to "banking" or dams produced by ice.

Mr. Petitt: One of the largest freshets of the Genesee was caused by a lumber blockade or jam.

Mr. Garfield: The expense of repairing bridges in my township is increasing yearly. The floods are so sudden that gorges are made, bridges swept away, fences torn down and trees uprooted, where a few years ago nothing of the kind was even dreamed of.

Mr. Fuller: Well, what of it? Raise the bridges so there will be no danger.

Hon. Henry Fralick: Floods are the result of clearing out the water courses. Years ago, when our rivers were full of logs, lumber and rubbish, the water was held back; now, as these have all been taken out there is nothing to prevent its rapidly rushing on its way. We had floods fifty years ago, but they were *slow* floods. The water, in consequence of the blocked condition of the rivers, rose slowly and as slowly sank away. Now they are *fast* floods. The water rises rapidly and rapidly subsides. It is plain from the nature of the case that the latter will usually do the most damage, but will

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any method of forestry prevent fast floods and induce slow ones, since clearing our water courses?

Mr. Hill: I suppose we must accept our fate and do the best we can now that our forests are gone.

Rev. Chas. Fluher: That is is not the right view. A true philosopher seeks the causes and tries to effect a remedy *there*.

This discussion was followed by the reading, by Mr. Garfield, of the following paper, entitled:

UTILIZING BARREN KNOLLS AND OTHER WASTE PLACES—FOREST AND WHEAT CULTURE.

[BY HON. L. D. WATKINS, MANCHESTER, MICH.]

There are very few farms in southern Michigan that have not more or less waste land which could be made valuable by the proper planting of trees. I have in mind steep hill-sides and other slopes that have been stripped of timber, and whose upper soil has, by constant washing, been made to cover with silt the valleys and levels below. How many such sad blots deface the landscape of our southern counties? These ugly landmarks might be made beautiful by planting with the common locust. This tree will grow rapidly on the poorest soil, and is the best known (not excepting red cedar) for fence posts. It reproduces freely by suckers; is never barked by stock or mice; is no longer troubled to any extent by the borer, and will hold itself in any soil.

Many of you have heard the late Dr. Warder tell of his purchase in Ohio of a farm of worn out sandy land that had been turned out as worthless for general farming. On this farm there was originally a row of locust trees lining each side of the highway. These in time spread over the entire tract and netted him, when cut for fence posts, three hundred dollars per acre.

We often see spots of fertile land cut off from fields by swamps, streams, ravines and roads. These should be planted to black walnut or white oak, the good qualities of which need no mention. There are also marshy, springy places that the owner cannot cultivate. On these the tamarack should be planted, as it grows freely in such places. It is a most beautiful tree in early spring; is first class for timber above ground and makes fairly good posts.

These are not all the benefits—far from it— to be had from clothing these useless places in living green. Few comprehend the protection of such wooded areas to the winter wheat crop. A notable instance—for which I can vouch—is afforded on the farm of Richard Green, Manchester, Michigan. He has grown large areas of winter wheat for over forty years on the same farm, consisting of about two hundred acres. Never has his crop yielded as low as twenty bushels per acre; the maximum forty-eight, six and one-half, and the average for the whole period has been twenty-eight and one-half bushels. Now mark, this farm has a continuous belt of timber on the south-west and north sides.

It would be interesting to solve the problem; How much land can be used for forest wind-breaks and still produce the same amount of wheat on the balance?

Mr. Garfield: I have noticed a direct relation between a small forest area—as a hedge row or narrow timber belt and a wheat field. A mere brush row

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in a neglected fence line would affect a strip twenty rods wide when on the windward side of the field.

Mr. ———: How far apart could one plant hedges or narrow timber belts and have all the ground protected fairly well?

Dr. Kedzie: It is remarkable how well even a lane fence will hold snow. Hedges forty rods apart would be sufficiently close to protect all the ground.

Mr. Hannah: Here comes in locality again. In the Traverse region we need nothing to hold the snow.

Mr. ———: You may need screens when your forests are gone.

Mr. Hathaway: I had a corn field, of which two-thirds was protected by a wind-break. The other third was more or less open to the winds. On a strip fifteen rods wide next the wind-break there was no soft corn. On the next twenty-five rods there was some soft corn, and on the remaining part of the field over which the wind had a clean sweep, there was much soft corn.

Mr. Baur: In Germany they get down to the bottom of this subject. They have fifteen schools of forestry and these rank with the best schools they have. We must do the same. There should be chairs of forestry in every agricultural school in the country. In 1858, I petitioned our Legislature to pass a law requiring all north and south roads to be lined on both sides with evergreen trees, and all east and west roads to be treated in the same way with deciduous and nut-bearing trees. Nothing was done, however.

Mr. Cook: In Illinois they let the Osage Orange grow eighteen or twenty feet high. In many places the roads are blockaded for weeks. The snow lodges on both sides of the hedge.

Afternoon Meeting.

Mr. Garfield then read a letter entitled:

WHAT I KNOW OF FOREST CULTURE.

[BY J. AUSTIN SCOTT, ANN ARBOR, MICH.]

As you are aware my home is located in a forest, surrounded on all sides by noble forest trees.

The forest grounds are not large, comprising only about eight acres, still there is quite a variety of trees—oaks, hickories, hard and soft maples, elms, black walnuts, butternuts, sassafrases and several others, with a good sprinkling of evergreens. The oaks predominate, and there are several species, quite a number of which are from two to five feet in diameter near the ground. These are indeed the lords of the forest. Then there are black oaks, yellow oaks, red oaks, pin oaks, burr oaks and others.

There are some twenty or thirty black walnuts, averaging from ten to twenty inches in diameter.

The young black walnut trees come up all over the grounds from the nuts that the squirrels plant for their winter food.

I have taken great pains to have the trees in this forest kept in good order, cutting off all dead limbs and unsightly branches, and removing such trees

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as I thought unsightly. Before cutting down a tree I look at it from every direction, and when the ax is uplifted the thought often comes to me, "Woodman, spare that tree," and that ax falls harmless to the ground. Many a tree now stands firm as a living monument to that thought.

I said I had a sprinkling of evergreens, viz: White, Austrian and Scotch pines, Norway spruce, arbor vitæ, hemlocks and others. I have a Norway hedge some thirty rods long and about seven feet high, so thick that you can not see through it. I also have one of arbor vitæ some eighteen feet high around a curve of my drive, and each hedge is as fine as I have ever seen.

And now, you will bear with me when I tell you that I am a great lover of trees. I have set a good many thousands of forest and fruit trees during my long and busy life, for I have set trees for the last seventy years.

I commenced setting trees when I was nine years old, and there has hardly been a year since that I have not set more or less trees. I have sometimes set several thousand in one year, mostly fruit trees. I could show you, if you would go with me to Connecticut, Toledo or Maumee, trees that I set out that are now about two feet in diameter.

In taking up trees I am very careful not to mar the roots and to be sure and get a good supply, and trim the top thoroughly so that the roots will predominate. I seldom lose a tree that I set, for I cultivate around the tree thoroughly and keep the ground mellow until the tree is growing well.

In traveling through cities, towns and country, I am generally looking out for the trees as I pass along, and I seldom pass a fine shade tree without looking at it, especially during spring, summer or autumn. It does me good to see a fine, symmetrical tree; it cheers and gladdens my heart.

The American elm I consider the best and most appropriate tree to plant in a village or city, as it needs less trimming, is long-lived and arches over a street so beautifully. Although it is not perhaps quite as symmetrical as the sugar maple and is not as good a shade tree, not being so thick, still I think it is preferable, as the maple, when trimmed, is spoiled of its beauty and symmetry.

There are other kinds of trees which are very appropriate for planting along the streets and roads. Basswood is a fine tree, white ash, black cherry and a number of others that I could mention.

When I came here, twenty years ago the coming spring, the second growth trees on my place were about six inches in diameter, and now many of them are from eighteen to twenty inches. Surely this is a good profit and a fair interest on the investment. Don't tell me that tree culture will not pay!

What can be finer than a forest with the underbrush all cleared off and the ground finely seeded down, making a beautiful lawn. Walking beneath these noble lords of the forest and looking up through nature to nature's God, one exclaims, Oh, how beautiful!

When the chill winds and frosts of autumn come, and the foliage begins to change from a deep green to a brown, yellow, and crimson, how glorious the scene! It seems like fairy land, and yet this beautiful scene can be witnessed in a bright autumn day in front of my little forest bordering the street.

I was glad when I read the notice of the meeting. It is one of deep interest to the good people of this State and our common country. It is a noble subject, and I hope the meeting will be one of deep interest, and great good be the result. I would love dearly to be present and add my mite, but my

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age warns me that my life's work is nearly done. With my best wishes, I am truly yours.

The chairman here announced that "Bills of Fare," as used at the Morton House, printed on veneering of basswood and bird's-eye maple, would be distributed free to the members of the Convention, with the compliments of the *Grand Rapids Democrat.*

HOW TO MANAGE THE RESERVE FARM WOOD-LOT.

[BY BENJAMIN HATHAWAY, LITTLE PRAIRIE RONDE.]

In presenting my views upon this subject, I will first give an outline of the method I pursued in handling my own reserved woods.

I will then suggest what may be done by every one who has a wood lot, who may think my method too elaborate and expensive.

I will also attempt to show what bearing my experience so far has upon the question:— Would it be profitable to invest in arable land in Michigan for growing timber?

In closing, I will point out some of the benefits, as I hold, of a systematic forest-tree planting, and more especially of timber belts and wind-breaks, benefits over and above the money value of the lumber and fuel produced— benefits not so obvious, but none the less real and substantial.

My first planting was a year or two before the war, when I set a hundred and thirty-six rods along the road on the west side of my farm, alternately a white pine and a sugar maple. I also set at the same time 80 rods on the south side of the road east and west across my place. These were all maple and set one rod apart.

The maple trees were taken from the woods at the time, rather open woods, were thrifty, fine trees, with good tops, from two to three inches in diameter, and grew almost to a tree.

The pines were nursery grown, from six to eight feet high, stocky and well rooted.

The maple trees are now about one foot in diameter, some of them less, but many of them more, and I have made sugar and syrup from them for five years.

The pine trees are not generally so large, though about the same height, yet some of these are over a foot.

To obtain the trees for planting the reserve wood-lot, I went to the same open woods where I got the maples for the roadside, but chose smaller sizes, averaging about an inch in diameter.

These I set in nursery rows, four feet apart, the trees eighteen inches to two feet in the row. Setting in this way two thousand maples, several hundred each of white pine, blue ash, white ash, spruce, cedar and other evergreens.

I also planted nuts of the chestnut, black walnut, butternut and shagbark hickory.

In preparing for the planting, I took in hand the woods I proposed to plant:—First twelve acres. This was nearly wooded with oak, having some twenty trees to the acre, two to four feet in diameter.

After clearing up the old logs and grubbing out the limited second growth, I went in with two men and a team, axes, saws and ladders, and we spent two

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weeks in trimming up the large oaks. We made clean bodies forty feet or more, saving the larger limbs for wood.

The ground was then plowed, summer fallowed and sowed to wheat, and seeded to timothy, clover, both white and red, and orchard grass.

It was thought by many to be but a piece of folly to attempt to grow wheat in so dense a woods, but the harvest gave me fifteen bushels to the acre for the whole piece, doing better than I had dared to hope. And the pasture that this woods-field gave me for several years went far towards paying for the improvement.

The next year I took eight acres more, treating it in the same manner, except that there was more grubbing to do and less trimming, the oak trees on this portion of the lot being smaller and less in number, and the second growth was more abundant and larger.

This was also plowed, sowed to wheat and seeded. The crop was not so good, however, about twelve bushels to the acre, I believe, though the pasture was even better than in the first field, owing, probably, to the fact of there being less shade.

It was three or four years after I set the trees in nursery before I re-set them in the woods. I waited until they had made a vigorous growth and were well rooted.

I laid off the ground with as much care as if it had been to plant an orchard. The rows were thirty feet apart, and for all kinds except the evergreen, eight feet in the row. The pine, spruce, etc., were sixteen feet apart.

I used a line twenty rods long, streching it on the line of the row, and measuring carefully on the line, I set stakes at each eight feet, except when the original oaks interfered, when I would skip a space or two.

The holes were dug two feet across, the marking being done with a tool made on purpose, and something like a large pair of compasses, with handles attached, so large that a man could stand up and strike the circle.

In digging the trees, I first plowed each side of a row two furrows deep, and then cut down between the trees with a sharp spade, trimming the ball of earth attached, to about eighteen inches in diameter. The tree, with the ball of earth attached, being about all one man could readily handle.

Again, the trees were carefully assorted, as at the first setting, to insure a more even stand, and then were drawn to the woods on a log-boat, or slide, and about fifteen trees made a full load for two teams.

By leaving about every tenth stake until the rest of the row was set, I was enabled by their help to attain to such a degree of accuracy in the planting as to be thought quite remarkable. Especially is this true of the plat of maples, some seven hundred, on the eight acres.

Not more than one per cent in the whole setting of the twenty acres failed to grow, although the pine and spruce trees were not set until the last days of May. They all, however, had balls of earth attached, which is an essential of success in the handling of all evergreens. In order to insure this result they should be set in nursery in the heaviest soil obtainable.

The pine and spruce trees on the twelve acres are the largest of any set at the time, averaging nearly a foot in diameter a foot from the ground. They are thirty to forty feet high and growing vigorously.

The blue ash and a few of the walnut trees planted in the shade, have not done very well. The white ash, however, I count one of the most valuable. And the maple seems to do fairly well in partial shade, though the trees growing more open to the sun are the best.

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I have already utilized some of the maples on both the twelve and the eight acres for syrup and sugar, and more are of suitable size.

In the last field planted, the timber was all, or nearly all taken off before the trees were set. Half the ground was originally planted to chestnut trees, which grew well, but half or more were killed by my sheep ten years later, they having been turned into the field by my man in charge, during my absence in the fall and the early spring, when the pasture was short.

Such of the trees as escaped destruction have been in bearing several years and many of them show a decided improvement over the common wild nut. Several of the trees show such points of merit as to warrant, I think, their propagation by grafting. One tree bears nuts especially fine. Many trees I found with five nuts, several with seven, and one with eleven, all very large and perfect, and of an even size and bright color.

Several rows were planted to European Larch, four feet apart, which have grown well, and promise to be among the most valuable ultimately.

A couple of rows of whitewood are very thrifty, and the other rows, of cedar and pine, are doing well.

I have not yet relinquished the cultivation of this field, it being now mostly in raspberries, which do well in the partial shade. I think that the raspberry and the blackberry both are better for the protection and shade than in the open ground.

TREES IN LINE OF FENCE-ROWS.

I have two rows of black walnut trees planted in the fence corners, forty rods long, standing one rod apart, that have been in bearing ten years or more. These, standing in open field, have grown much faster than the walnut trees planted in the woods.

I also planted some years later a row of black walnut trees one hundred rods long on the line between my farm and a neighbor's on the east. These I intend to utilize in the spring to support a wire and picket fence, which they are abundantly large enough to do. A portion of them failed in setting, and I will probably need to supply the places of some twenty or more with ordinary posts.

Touching the subject of line-trees for the support of fence, it may be in order to call your attention to what I have done in the way of planting apple trees for this purpose, as well as for fruit.

Through the middle of my north forty acres I have a row of the Wagener apple, planted ten feet apart. They have been growing seven years, and last fall they gave me about fifty bushels of apples. They were headed high—as, by the way, all apple trees should be—and are capable of supporting a fence, without detriment to the trees.

And along the east and west road I have also a row of the Red Canada apples grafted on Northern Spy, that are just coming into bearing, a row forty rods long planted at same distance, of ten feet.

I have, in addition, a row one hundred rods long, mostly Red Canada, opposite the twenty acres of reserved woods, along the road, which are beginning to bear fruit and can be used also for fence support in a few years, should a fence be required.

For myself, I believe that there are advantages in this planting of apple trees on the dividing line of fields and along the roadside that are worthy of being considered.

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Returning again to the main subject, I will say, that by care in felling the old trees and by a judicious trimming of the new growth, very much can be done to improve the wood lot with little expense.

Adjoining mine on the south, my brother has forty or fifty acres of woods. His was like mine, except that his had more second growth, consisting of white oak, red oak and hickory.

Twenty years ago he went in and thinned them out, leaving half, often less, of the largest and best sorts, and the difference between the young trees on this lot and on the lot adjoining, where no improvement has been attempted, is very marked, and in favor of the trimming.

A second trimming would now be of great advantage, and the waste would well repay the labor of cutting out for hoop-poles and for fuel.

It is evident that the struggle for existence has again set in and though the weaker trees will die out of themselves, they are a detriment to those that survive.

Every farm should have its nursery for the growth of forest trees, so that whenever large trees are taken out, leaving an open space, a half dozen, more or less, of the nursery trees can be set out.

These farm nurseries should be from one-half acre to one or more acres in extent. They could be cheaply stocked by sending to the large commercial nurseries, where seedlings can be bought at a merely nominal price of all the leading desirable kinds, or, as it often would happen, they could be stocked with small trees from the woods where they grow too thickly, and nuts of the walnut, butternut and chestnut could be planted, so making a desirable variety, and at cost only of a few days' labor.

TREE PLANTING IN ITS COMMERCIAL ASPECT.

While I do not propose to discuss this question at length, one feature of my experience has so direct a bearing upon this point that I think I may count upon your interest and patience while I give you very briefly the facts.

Several years ago I sold the oak trees on the lower field, the eight acres, receiving for it $336, or at the rate of $42 per acre.

The tops I reserved, which were worth for wood about $8 per acre more.

The oak timber on the twelve acres, being much the best, would bring, at least, $700 to-day, and the tops, for fire-wood, could be safely reckoned at $100 more, making the whole amount $1,200.

Besides, I have taken off since the replanting some fifty dollars' worth of staves, and in addition, rails, saw-timber and fuel to the amount of fifty dollars more.

But leaving this last item out of the account, the oak timber sold and to sell would pay an annual rent of $50 on the twenty acres, or $2.50 a year per acre for twenty-four years, the time the trees have been set, leaving a well started, thrifty young forest to replace the one taken off, which young forest would enable the farm to still sell for as much as it would, had the oak timber remained and no replanting been done.

And I am strongly of the opinion that the farm would be counted more valuable in the estimation of most men who might look over the three thousand vigorous, thrifty, re-planted forest trees, many of them now one foot in diameter, that are to be replace the less than one-sixth of that number of the original forest, however valuable that might be.

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It has been experimentally demonstrated farther west that by a systematic planting of evergreen screens the climate may be ameliorated to the extent of ten degrees within the area of a single farm, less than a mile in extent either way. And yet I am well aware that there are men, perhaps in this hall, who still doubt the value of timber-belts in this State.

If there could be a belt of white pine or spruce trees planted, one rod apart, on the west and north of every eighty acres of tillable cleared land in Michigan, I believe that in twenty years there would result so marked an amelioration in our climate that it would be a surprise to the doubter, at least.

There would be no more snow-drifted roads, which alone would repay the cost. We could, no doubt, grow fruits successfully that are too tender for us now, while the heaving out of clover and the winter-killing of wheat would probably be things of the past.

Yet these, and greater benefits than these, I hold to be the natural and therefore the sure results of a wisely conducted planting of timber-belts or screens.

And one of the greatest, if not altogether the greatest, of all the good results will be found to be in the continually increasing productiveness of the soil.

While it may wait for science to demonstrate the how of it, the fact remains, as careful experiment and a wide observation will abundantly prove.

Let me call your attention once more to the row of maples and pines on the west and north of my place. This, supplemented as it is, by a high thorn hedge, forms one of the best wind-breaks in the State, no doubt.

I believe that the belt of trees has repaid me many times the cost of growing it in the increased fertility of the protected land.

And, further than this, I believe that my neighbor on the west has received almost as much benefit from this belt of trees as I have, and that it would have paid him well to have planted the same trees, in the same place, had I not done it.

It has been said that the snow is the poor man's manure. Whatever of truth there may be in the saying will be doubly true, and not for the poor man alone, when every farm, being protected, will have at least its own, when the beautiful snow, with its burden of benefactions, will lie like a mantle of charity upon the world. But there is more in this than the snow, for where the snow shall lie in the winter, there shall the fertility-ladened air and the warm sunshine of the summer linger lovingly upon the landscape; and the growing meadows, the waving wheat, and the springing corn, no longer compelled to battle with the wayward winds, as aware of the more genial environment, will once more repay the toil of the husbandman with abundant harvests.

Mr. ———: What kind of a fence do you have where the trees act as posts?

Mr. Hathaway: Wire and picket. In one instance pickets were cut from eight-foot whitewood boards that had been used for fifteen years on a tight-board fence. They were then put into a wire and picket fence and have done good service for twenty years. There are now only two bad spots in many rods of the fence, and those were made by careless teaming. There is a profitable subject for study in this matter of apple trees for fence posts.

Mr. Robinson: Has this experiment of tree planting been for fancy or for profit?

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Mr. Hathaway: It *has* been profitable, without saying anything about the fanciful part. A very large landholder in my vicinity says it would be profitable even if a strip six rods wide were lost to cultivation of crops on both the north and west sides of every eighty acres that he owns.

Mr. Beecher: What will be the value of those trees used as screens twenty years from now compared with the present value?

Mr. Hathaway: One dollar now. The future value will depend on future demands.

Question: How thick would you plant pines?

Answer: Thicker on cleared land than in a forest. In the forest I planted eighty to the acre.

Mr. Chamberlain: What is the relative growth of pines and deciduous trees as you planted them in your forest?

Mr. Hathaway: The pines take the lead.

Mr. Garfield: How much is your farm worth, more or less, than it would be without the timber you have planted?

Mr. Hathaway: Some men would say no more, others would say much more.

Question: Given two farms of equal size; if from the one you take off all the timber and on the other you leave a fair share of the forest and give it good care, which is worth the more to-day?

Mr. Hathaway: The one with a forest growth would be the more valuable in our section.

Mr. G. S. Linderman: Which would you prefer, a farm in a section where there are no forests or one where every farm is protected like Mr. Hathaway's?

Answer: The latter, most assuredly.

Mr. Cook: I think Mr. Hathaway's remarks about trimming trees re very good. If trimming is done early it is a good thing, but if trees are 1 ft long without trimming the scars will be dangerous to the tree's welfare.

Mr. Cobb: When is the best time to set pines?

Mr. Hathaway: Just after starting to grow in spring—about the fifteenth of May, perhaps. Cut them back and set with a good ball of earth around them.

Question: In cutting in your forest, how do you get the large trees out without injuring the small ones?

Mr. Hathaway: It can not always be done. Your only way is to fall them between the rows as well as you can.

Question: Where do you set out evergreen trees from a distant nursery?

Mr. Hathaway: First set in nursery rows, carefully shade and water them, and after one year transplant to their permanent places. But, if you have time, it is better to grow them from seed.

Question: Why not plant all fruit trees instead of forest trees?

Answer: Because they can not take the place of both forest and fruit trees with equal results. They have their uses, but they are not profitable forest trees.

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FOREST FIRES—PREVENTIVE LEGISLATION.

[BY ARTHUR HILL, OF SAGINAW.]

Gentlemen of the Forestry Convention:—

It was said by the philosopher Humboldt that men in all climates bring upon future generations two great calamities at once, a want of wood and a scarcity of water.

In the State of Michigan, with our great stretches of forest and surrounded by lakes, which tend to make the climate humid, these calamities seem far remote, but it is an easy computation to show that at the present rate of destruction our forests would be practically swept away within the term of half a century.

It is an accepted fact that fire is an important agent in forest destruction, and upon the request of the State Forestry Commission, which has taken up the laudable and patriotic purpose of perpetuating the forests of the State to the extent which sound economy requires, I present a few suggestions on the subject of legislation to prevent forest fires.

To show how these fires originate, I submit the record for the State of a specimen year, as presented in the forestry section of the U. S. Census Reports of 1880.

In all 267 forest fires were reported, originating as follows:

From clearing land	161
From locomotives	43
From hunters	59
From smokers	8
From Indians	1

These figures suggest the necessity for laws which shall prevent one man in burning over his land from endangering or destroying the timber, crops or improvements of another.

Next, the necessity of compelling railroad companies to use the greatest precautions against the setting of fires by locomotives; and, finally, the need of reasonable but stringent regulations directed mainly against hunters of game and land explorers, punishing them for willfully or carelessly setting fire to forests not their own. The fatal and devastating forest fires of 1871 and 1881 originated mainly with settlers' fires and locomotive sparks and cinders.

Settlers in clearing lands fired stumps and brush-heaps, because the weather was hot and dry and they could get a "good burn," having little regard for the danger they were bringing upon their neighbors.

The railroad companies sowed seeds of fire along their entire lines, yet took no proper and efficient steps in the wooded sections to save other than their own property, while wanton and malevolent strollers contributed their share to the chapter of calamities. This carelessness, or worse than carelessness, recurs with each succeeding year, the damage done depending upon the dryness of the season. And, speaking especially of our forests and their preservation, it would seem that the time had come when this lawlessness should be succeeded by the reign of law.

We now have laws generally designed to protect forest property from damage by fire, but in my judgment we need more specific regulations, and we

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need also a system of fire wardens specially charged with the protection of fields and forests from fire in their allotted districts.

The forests of the State are of vastly more importance than the wild game which they shelter and sustain. Yet we have a well defined game law, with an efficient corps of game wardens to enforce it, while the forests receive from the State substantially no protection against fire, their most destructive enemy.

After a brief review of such authorities as were accessible bearing on the subject of forestry legislation in the light of my experience in the forests of Northern Michigan, I have arrived at the conclusion, that the laws for the prevention of field and forest fires should contain:—

1. A provision making the supervisor of each township fire warden of his township and defining his powers and duties and fixing a fair rate of compensation for his services.

2. A provision substantially the same as section 1, chapter 328, Compiled Laws, which provides that every person who shall willfully or negligently set fire to any woods, prairies, or grounds not his own property, or willfully or negligently permit any fire to pass from his own woods, prairies or grounds to the injury or destruction of the property of any other person shall be deemed guilty of a misdemeanor punishable with fine or imprisonment, or both, the party injured to have double damages for the injuries sustained.

3. A prohibition against the building of fires by persons clearing land during the period from April first to November first in each year, without the consent of the fire warden in writing, with previous notice to owners or occupants of adjoining lands.

4. Provisions as to railroad companies, requiring them to keep their right of way clean of dead herbage and other combustible materal and compelling any railroad company, upon the written request of any fire warden through whose jurisdiction its road passes, in times of danger, to burn coal instead of wood for locomotive fuel, and to employ a corps of men to be known and to act as a "fire patrol," whose special duty it shall be to prevent fires in and along the right of way, and to suppress fires originating in the right of way, and compelling the company at all times to use extreme diligence in preventing and suppressing fires kindled by the companies, their agents and employés.

This indicates the general line of legislation which seems to me desirable. The act creating the Forestry Commission makes it the duty of the supervisors to furnish to the commission statistics as to forest resources and forest fires, and he seems for this and other reasons the proper person to act as fire warden. The provision against the setting of fires during certain periods in clearing land is substantially borrowed from certain forest regulations in France, where the local prefect is required to give his permission, and the effect has been to greatly diminish the number and extent of forest fires.

As to the railroad companies, they are able and should be willing to actively protect the property which they endanger, and the provision for a special fire patrol, therefore seems reasonable.

The lumbering fraternity, to which I belong, as well as game and land hunters, are inexcusably careless in the use of fire.

To set fire to a building in a city worth $500 they would deem a crime, yet they will kindle a smudge or camp fire and carelessly allow it to spread and destroy a forest growth worth $5,000, without a pang of conscience,

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simply because they have not been educated to a proper sense of responsibility for such acts.

Well considered laws, strictly enforced, will prove the best educators in this direction. They will act as a restraint on lawlessness and carelessness and as a prudential guard against natural calamities.

But our experience under present forest laws shows that no law will be effective to the end desired unless some officer is especially charged with its enforcement.

That is the essential point, the one which in any new legislation the friends of the forest must not yield, and once gained, Michigan, first among all the States in forest wealth, will still be first in giving to her forests due protection.

Mr. Baur: I think supervisors would not be efficient fire wardens; we need schooled men. We must teach the principles of forestry to the young in our schools.

Mr. R. C. Sessions: That is very good, but we cannot wait for schooled men; we want men to protect our forests *now*. We must have legislation at once. Hunters are so careless, and lumbermen so reckless, that we *must* have law immediately. Laws that will make lumbermen and others clear up the rubbish they leave carelessly strewn around them, are needed now.

Geo. Taylor: In England and Scotland the land is owned by the few, and thus it becomes easier to manage this forestry question.

Mr. Fralick: Can the brush tops be cleaned up?

Mr. Hill: Practically, no. There is twice as much hardwood on a given tract as pine, and in burning the pine tops inestimable damage to the standing would be done. It is the railroads that are responsible for most of these fires, they are exceedingly careless. Fires in running through hardwood forests do much more damage than is usually supposed. A fire running over a black ash swamp, for instance, stunts the growth and makes it unfit for hoop purposes at least.

Mr. Hathaway: I think the brush and tops can be burned in the winter without much damage.

Mr. Fralick: It is impracticable to compel lumbermen to clean up tops and rubbish after cutting. How can you enforce a man to do such work when the land is only worth fifty cents per acre, and the owners living miles away from the place, perhaps out of the State. The work must be done by State agents.

Question: What is the need of burning brush if good fire laws are to be enforced and proper precautions are taken against kindling fires.

Mr. Hill: There is no use.

Mr. Sessions: It is impracticable to burn these tops with any degree of satisfaction and safety. We want *stringent* laws to protect *against* fires.

Mr. Cook: These tops could be cheaply made into charcoal.

Dr. Beal: They could be used for wood alcohol, also.

Mr. Chamberlain: A license is the best thing to prevent fires. Make a law so that no man can fire a brush heap until he has a license from the proper official.

Mr. Hannah: It is common for large lumbermen to burn a strip in spring around their winter choppings to protect themselves from the carelessness of berry-pickers, against whom it would be impossible to legislate. Our forests of both pine and hardwood must go, as they are at present, and when we need more we must reset.

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Mr. Hill: It is protection against fires that we need and not against cutting for commercial purposes. Such a law would be an educator to berry-pickers and would stop a great part of their carelessness.

Mr. Hannah: I would like to see a law passed forbidding anyone killing deer for five years. It would fill our woods with harmless and beautiful animals that would add an inestimable attraction to our forest. [Applause.]

Mr. Beecher: We might protect, not only forests, but denuded regions. I agree with Messrs. Hill and Chamberlain, that it is the duty of the State to put down the thumb screws pretty stiffly on this point. Hon. O. Palmer, of Grayling, told me that one of the worst results of forest fires was the burning off of vegetable matter from the soil, thus destroying its fertility.

Dr. Kedzie: There is another loss from these fires, viz: The destruction of the young forest growth. A friend told me that he had protected four hundred acres of jack pines. In a few years it became covered with Norway pines. He said jack pines are not as easily destroyed by fire as the other species, and they soon grow up and afford a shade for nursing the weaker ones.

Mr. Hannah: In parts of Michigan, where there is a good sub-soil, you can make good land of it by keeping out fires, but not otherwise.

Mr. Beecher: Hon. O. Palmer says when fires are kept out the natural grasses grow.

Mr. Hannah: I can show you hundreds of acres bare of forests and over which fires have not swept for years. There are no natural grasses there, save in places where logging and other teaming has been done. These lands have been worthless for years, are still so, and will be until hundreds of dollars per acre are laid out on them.

Mr. C. S. Killmer: I doubt the possibility of preventing spreading fires by legislation. That which has been proposed here to-day will affect chiefly the settlers in those new counties who are making them of value, and who would be pevented by such laws from clearing their land except at great inconvenience. I would urge instead the methods proposed by Mr. Hathaway.

Mr. Chamberlain: I think the gentleman misapprehends Mr. Hill's position. I have cleared hundreds of acres of land—wet lands, swamp lands, clays and bogs—and I think I understand it thoroughly. The law is not to prevent legitimate fires, but to have the judgment of a responsible officer as a protection to the public against mulish men.

Mr. Hill: There is nothing iron-clad as to the suggestions for laws, nor are they suggested only for the lumberman's protection. It is as much for the protection of the settler against his foolish neighbor as any one, that I would have such laws.

Mr. Kilmer: Then I should think a judicious law desirable.

Continuing the subject of forest fires, Dr. W. J. Beal spoke as follows:

Forest fires occur in a great variety of ways, and when once started they may spread over large areas, doing great damage. 1. They often spread where a man burns brush, logs or a fallow to clear land. 2. From burning wheat or oat stubble. 3. From burning to kill the underbrush to permit grass to grow for cattle. 4. Spreading from railroads, especially where wood is used for fuel; spread from sparks of the engine, from coals along the track, from burning rubbish along the road. 5. Spreading from camp fires, fishing or hunting parties, careless use of matches, pipes, cigars, guns. 7. From burning coal pits. 8. Fires are not unfrequently set by timber thieves for

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the purpose of burning rubbish and covering their tracks. Fires are especially liable to occur where dead, dry tops and rubbish are left after cutting pines, hemlocks or other cone-bearing trees. The dead leaves and pitch in the wood makes the fires burn with great fury in a dry time. Fires are common on sandy or gravelly lands, which dry out sooner and more completely than clay or loam. A rank undergrowth often shades the soil, making the spread of fires less frequent. In Michigan fires are seldom known in winter, but occur in spring, if very dry, when vegetation has made little progress. In a dry summer or autumn our worst forest fires usually occur. Fires do more damage in dry countries than in moist ones. Fires not only destroy dead timber and rubbish, but destroy that which is alive and standing; they destroy timber which is cut for use as logs, posts, ties, cord-wood, tanbark; fires destroy fences, bridges, buildings, mills, lumber, crops, etc. In some cases fires sweep everything down, as in Huron district in 1881. Fires burn the vegetable matter in the soil, and thus injure it for producing plant growth. Excepting the woodman's ax, forests suffer more from fires than from any other cause. This danger we can no longer ignore. We ought to study this subject thoroughly, and make a strong effort to prevent the spread of fire. The destruction by fires is enormous, even in the State of Michigan, though it is very difficult to give reliable figures. From the tenth census in 1880 we learn something in reference to the losses by fire in that year in the United States.

	Acres Burned.	Prop. Destroyed.
California	356,800	$440,000
Colorado	113,800	935,500
Michigan	238,000	985,980
Minnesota	250,000	1,398,000
Montana	88,000	1,128,000
Pennsylvania	685,700	3,643,000
Tennessee	985,000	5,253,900
Wyoming	83,000	3,255,000

Other losses are not here enumerated. In the United States during 1880, 10,274,089 acres were burned over, causing a loss of $25,462,250. This is the actual money value of the loss of the timber and buildings, and does not take into account the damage to the soil, seeds and tree seedlings. The largest number of fires was traced to farmers in clearing land and was 1,152; caused by hunters, 628; locomotives, 508; malice, thieves, etc., 262. The total money value of fire-wood during 1880 was $306,950,000. The loss by fire was about one-twelfth of that used for fuel. The money value of timber during that year used for lumber ties, etc., in the United States, so far as could be ascertained was $184,000,000. That destroyed by fire was equal to about one-seventh that cut for lumber, ties, posts, bridges, etc. A hard fire in forests of pine and spruce destroys the seeds and all the young trees, hence some other sorts must take their places unless some artificial means are employed. Such a burned district soon produces a growth of briars, small birches, poplars and red cherry, of no economic value. Some oaks survive the fire by way of grubs, which thrust up sprouts. "In the South Atlantic States, through the agency of fires, less valuable species of pines have gradually spread and now occupy the ground." At the expense of the forests stockmen have been benefited. "In some portions of Washington Territory and Oregon the firs, when destroyed by fire, are quickly replaced by a vigorous growth. Seedling trees follow the destruction of the redwoods of California." To aid in preventing this fearful loss of timber and other property by forest fires, which

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bring good to no one, numerous suggestions are here made: 1. In new countries, where fires are liable to occur, let the supervisors make rules in regard to the time and manner of firing brush and rubbish. They might prohibit the burning during certain seasons of the year. In Quebec, in 1882, a law was passed to this effect: "No person shall, in the forest, or at a distance of less than a mile from a forest, set fire to, or cause to burn, any pile of wood, branches or brush-wood, or any tree, shrub or other plant during the year. It, however, shall be permitted for clearing lands at any time except between July 1 and September 1." 2. Allow each township to elect a fire warden, who shall take chief direction in arresting fires, in ordering back fires, the township paying the damage. 3. Require a person to get a permit before firing brush or a field, and compel him to notify his neighbors a day or so in advance. 4. No one shall kindle any fire in a wood-land nearer than 200 yards of its border, unless all rubbish is cleared away for six feet, and then the fire must not be left burning. 5. In firing charcoal, provision should be made for having water ready to use, and all combustible material should be removed fifty feet from the kiln. 6. Railroad companies shall remove dead herbage along their right of way and burn when not too dry, with a force to guard it, or else keep the land cultivated. Most, or some of the roads in the older parts of our State, already adopt this plan. 7. When deemed best a warden may order a space cleared of rubbish through a forest of at least fifty feet. The practice of clearing away strips of certain distances through forests is much practiced in Germany and in other old countries. These strips can be burned over when not very dry. 8. Forbid throwing down a burning match or lighted cigar in the woods unless extinguishing the same at once; forbid using fire-arms in dry weather. 9. Post notices in conspicuous places; have notices given the churches and schools and in the local papers; circulate tracts, and take every precaution to distribute information in reference to preventing forest fires. 10. To have fire flags displayed at signal stations and on railroad trains in times when there is much danger of fire.

In Massachusetts, in 1882, a law was passed as follows: Fining of over $100 or imprisonment not over six months for wantonly or recklessly setting fire to any material which causes the destruction of any growing or standing wood of another. "In looking the whole matter over, we see how much might be avoided with due caution; how much might be saved by a little timely thought and care; by instilling into the minds of the young in our families and our schools those habits of caution and prudence." Several journeys by rail at different times through the northern part of our State has given me an opportunity to see the country passed through. In many places for miles along the track, and for long distances each way, a scattered miscellaneous growth of briars, red cherry, poplars, willows, etc., is springing up among the black and charred trees and the logs where they fell. The first impression of this view can never be eraced from one's mind. It gives a desolate and forlorn appearance to the country and one far from favorable. Massachusetts Board of Agriculture, p. 278, 1882. "The single danger which threatens property in the form of young pines is the danger, real or imaginary, of destruction by forest fires. If this danger and the dread of it could be removed, or at least greatly reduced, an investment in young pines growing in New England would promise to capital, in the long run, larger returns than could be derived from almost any other legitimate business enterprise; but so long as this dread of fire exists capital will naturally content

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itself with smaller and more certain returns. Better legislation than now exists for their protection must be secured, and then the public mind must be educated to the importance of forest protection.

"Legislation in advance of public sentiment cannot be expected to accomplish any very marked results. Locomotives should be provided with spark-consumers. In Europe they are in general use. The custom of leaving scattered about the ground the tops and branches of trees cut during the winter should be forbidden by law, as it is a great danger to the public. This debris can be burned in winter when the trees are cut."

Mr. Fernow described systems of fire protection, and stated that in some systems the fire wardens have the right to call on any one to help put out fires, and many people objected to being called upon to help quench fires on others' property.

Mr. Hollister: It is a fact that in our northern pineries many of our fires are set for the purpose of giving employment to a certain class. The G. R. & I. have become impressed with this idea and so have put their lands in market. But legislation is needed to protect this great product.

Mr. Cook: In regard to fire wardens, it might work well in some counties where the supervisor had the time to attend to it if he were appointed.

Mr. Garfield: Where the supervisor has property it might be dangerous for him to enforce the law.

Mr. Fernow: When the supervisors have no property, or little, they would be better fitted to enforce the law.

Mr. Cook: I would suggest such a system as that of the game law.

Mr. Sessions: Farmers generally clear their lands between June and September. I have been a farmer myself and know how it was. Brush is too green before July, though sometimes an early dry day comes. Late fall is a bad time for forest fires on account of the dry new fallen leaves. No fire runs far in the summer in timber land. Fire in the pineries is a different thing on account of the pitch in the trees.

C. S. Kilmer: Who is to pay for the protection of the timber of the non-resident? They may be assessed any amount, and what do they care? We all know the State tax laws. I think the tax paid fire wardens should be paid by the State, and not by the poor people of the country.

Mr. Fernow: The tax should be paid by the State for the protection of property. It is not a question of forestry at all.

C. S. Kilmer: It is almost impossible to execute an unpopular law. A system of wardens under a chief is the best way to reach it.

Mr. Hathaway: What would be the best system to be adopted by the State?

Mr. Fernow: I think several different systems have their good points. One is that where lumbermen unite and pay men to watch the woods during the dangerous season, the lumbermen paying one half and the government the other half. There are several other plans also. I have had some experience in the working of forest fire laws. Almost all States have such laws, though in many they are inactive.

In Pennsylvania when my property a few years ago was threatened with destruction by fires, I searched the laws and found an act authorizing the appointment of fire wardens, but up to that time none had been appointed. I demanded their appointment, but it was only complied with when I took steps to bring the matter into court. This has been the means during late years of preventing destructive fires.

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H. J. Hollister: Many forest fires are set by men for the purpose of compelling the using of the lumber at once that they may get employment the following season; and, also, by persons wanting to buy a tract of land, thinking by this means to lessen the price. Now, protection from these fires means expensive supervision, but it is worth the cost.

Mr. Cook: Mr. Hill suggested making the supervisor a warden. He could not give time enough to the subject—

Dr. Beal: Then let him appoint a warden.

Mr. Garfield: Is it not true than when fires occur most of the supervisors have the least other duties to perform?

Mr. Fernow: People who have property of their own liable to injury often object to acting as fire wardens. The warden's work of necessity excites irritation and if he is a man of little property malice will have less to work upon.

Mr. Cook: I think these wardens ought to be subordinate to a central head for the State fire service, as the State game warden and his deputies.

Mr. Sessions: As to clearing land on our farms and restricting the burning of rubbish from September to June. I think that is just the time when it is most convenient to burn. Let a man burn when he wants to, but fine him if it escapes and does any damage. Besides, the worst time for the spreading of fires is in October, after the leaves have fallen.

Chairman: How would you protect against careless people?

Mr. Sessions: I am now speaking of *careful* people.

Mr. C. S. Kilmer: Circumstances vary so much that it would be difficult to make even a general law apply.

You can't put out a fire that has once started running on a sandy ridge. I don't think communities should be called upon to pay for a system of fire protection. The expense should be borne by the general public—a State tax intead of a local one.

Mr. Baur: The supervisors are in general poor persons to take interest in Forestry matters. Interest in the subject must first be worked up in our Horticultural and Agricultural societies and we must have young men educated in Forestry with a prospect of remuneration.

Mr. Fernow: I think Mr. Kilmer's views about the expense of fire protection right.

Mr. Kilmer: The wardens ought not to be resident owners in the district where they have charge. They should be deputies of a State officer.

Mr. Hathaway: As to the method: does Mr. Fernow advocate the fire warden plan?

Mr. Fernow: I would advise that plan which is the most effective in the locality. In general, I would combine the Pennsylvania plan of fire wardens appointed by the county commissioners of each county and the Canadian plan, where the lumbermen and the State combine, half and half, during the dangerous season and employ a fire patrol to extinguish and warn against fires. It was optional with the Canadian lumbermen to have the system or not, and it has worked so well that it is extremely popular.

[The evening meeting was held in the Universalist church, and consisted mainly of exercises by the children of the public schools of the city. The recitations, songs, dialogues, etc., were such as would be suited to an Arbor Day. The report of these exercises will soon follow in time for use on Arbor Day of 1888.]

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Friday Morning Session.

The chairman opened the meeting by reading the following:

"Would it be profitable to invest in arable land in Michigan for growing timber?"

Martin Conrad, Monroe street, Chicago, Ill., for some twenty years foreman of the largest wagon works in that city, gives a mechanic's view of this question.

Five sorts of timber are foremost in the construction of wagons.

First. White oak (including swamp white oak), maturing for wagon work in eighty years or less.

Second. Shell-bark hickory, maturing or fit for use in thirty to fifty years.

Third. White ash, now becoming very scarce but very valuable, fit to use in thirty years.

Fourth.—The tulip tree, or whitewood, superior for carriage bodies, wagon boxes, requiring sixty years or more to get fit to use.

Fifth. Red or Norway pine requiring at least sixty years before it is profitable to cut for the bottoms of wagon boxes.

In growing trees men forget that an acre of well grown timber, artificially grown, is worth five times as much as one that has grown in a natural way.

Mr. Conrad, after studying what has been done in a limited scale, estimates that one good tree would grow to the rod, 160 to the acre—say 110 to the acre after eighty years.

We start with 2,700 to the acre, and thin them as they grow, when eighty years old each should make 500 feet of lumber, or 55,000 feet to the acre, worth in Chicago now $1,430, and in eighty years, no doubt, it will be worth $50 per 1,000, or $2,750.

The cost of raising is much reduced by thinning, the tan bark, etc.

A man need not wait eighty years to realize money on the timber, as young timber can be sold with the land. It has a prospective value, as a pig, a colt or calf. Young timber is on the line of a permanent improvement.

Dr. T. J. Burrill, Prof. of Botany and Horticulture, in Illinois, does not believe that forest tree plantations will be profitable as a farm crop on land which is fit for wheat and corn. In Illinois good soft coal can be had for fuel at two to three dollars per ton.

Mr. ———: What are the most promising kinds of timber trees to grow for profit?

Mr. Cook: Black walnut and white ash.

Mr. Hathaway: That question can not be answered until we have considered the locality and soil. Black walnut will thrive in only a small portion of the State, and it is not profitable to grow white ash on all soils.

Mr. Garfield: This matter of soil is very important. On my farm are many black walnuts that were planted fifty years ago, and they are not yet fit for furniture, whereas on that soil (a light one) the ash would in that time have been ready for market.

Mr. Pearsall: Thirty-five years ago I planted walnuts and butternuts in my fence corners, and though the trees are not fit for lumber they yield an abundance of nuts, which are much better in quality than the forest products. The trees can be set out when one year old as easily as cabbages.

Mr. Garfield then read a letter on

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NOTES ON TIMBER FOR HOOP-POLES.

[BY PROF. JAMES SATTERLEE, OF LANSING, MICH.]

Which one of our native trees will grow good hoop-poles quickest? This important question can be easily answered by looking over a tract of land on which the timber has been cut within a few years and allowed to grow up again. One will be surprised at the rapid growth of many of the "sprouts." A short time ago, while tramping in the woods near this city, my attention was attracted to some bitternut shoots of one and two years' growth springing from the stumps of saplings that had been cut close to the ground for poles. One of a single year's growth had reached a height of seven feet, and one of two years' growth had reached a height of ten feet. A growth of six feet in height in a single season was very common. Among the other hard woods I could find none that had made a growth of more than four feet in a single season.

The growing of poles for market in southern Kansas and in some other parts of the southwest is said to be a very profitable industry, and this same bitternut, or yellow bud hickory as it is sometimes called, is the species planted. The saplings are large enough to cut in five or six years from the nut, and many of the sprouts that then spring up are large enough in three or four years to cut again. The bitternut grows best on strong, loamy soil, but will make a fair growth on any ordinary farming land, and is worthy of trial by anyone growing timber either for hoop-poles or wood.

Mr. Hathaway: I think walnuts, as a crop, are much less profitable than apples. They are worth about half as much as apples, and cost much more to market. They do not sell as well as butternuts or shell bark hickory nuts. The latter sell for twice as much as walnuts, and the trees are easily transplanted when one year old if the tap root is well preserved.

Mr. Fralick: If you want to raise timber for market you are looking to something which will not be realized in your lifetime. Apple orchards are a much more desirable means of timber production, for they pay for themselves as they go along. If you want a wind-break use Lombardy poplar or cotton-wood; they are both rapid growers.

Mr. Sessions: For profit there is no tree growing equal to the apple. Plant an orchard of the best varieties and realize profit as you go a'ong.

Mr. Cook: It is not fruit but timber production we are to consider, and for all timber uses the second growth is much the best.

Mr. H. J. Hollister: We need to take a wider view than merely that of immediate personal profit. In 1882 I visited the Black Forest in South Germany, and was struck with the policy which preserves it. In Wurtemburg the farmer has no right to cut timber on his own land without the consent of the Forestry authorities. The government considers the forests of the utmost moment to the welfare of the country, and when one acre is cut another must be planted. So it is in France, while in Russia and Italy it is the contrary. In these countries the matter is neglected, and the rivers are becoming intermittent torrents.

Dr. Beal: After ten years of experimenting I considered the hardy Catalpa one of the most profitable trees for timber, but from later observation I find it is too tender to be unreservedly recommended. If we can in some way outwit the borers the locust would be the most promising tree to grow. It is excellent for posts and buggy spokes and many other purposes.

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QUALITY OF TIMBER AS AFFECTED BY RAPIDITY OF GROWTH.

[BY E. R. LAKE, AGRICULTURAL COLLEGE.]

Samples of the virgin white pine of Michigan and the second growth pine of Massachusetts were compared by breaking across the grain. In the case of the former it splintered very much, while in the case of the latter it broke short off. The annular rings in second growth pine have a much larger proportion of thin-walled cells than does the virgin or slow growing pine, thus making the second growth light, soft and brash. In deciduous trees this rule is reversed, *i. e.*, rapid grown ash is tougher than that grown slowly.

Mr. Glidden: What is the best time to cut second growth timber for posts?

Mr. B. E. Fernow, of Washington, D. C.: As to rapidity of growth affecting strength of timber, I would say that wood changes in quality with age, so that these same fast grown pines which are so brash now may be much better when twice as old. Scotch pine is as good for building purposes at sixty-five years as white pine is at ninety. But after it has reached this age, white pine produces more timber and better quality than any other pine. Deciduous trees of second growth are of better quality, because they have more light and room to grow in. In general the quality is not affected by the time of felling, but by after treatment. If cut in sap it must be treated differently from what it should be if cut in the period of rest. If you cannot attend to after treatment then it is safe to cut in December, at which time the fermenting agencies in the wood will not be active. If cut during growth, then leave the tree whole with the leaves on, so that they will pump out the excess of moisture from the body. In Alabama, I saw the farmers cutting chestnut oaks and white oaks. The former were left to rot, while the latter were used for ties, whereas the former is the better timber for this purpose. Cut this tree during the period of growth, and take off the bark but let the leaves remain.

Mr. Coffinberry: I have had considerable experience in this matter. I once cut some timber in February; framed it in the fall, and found it literally full of borers. Another time I cut smooth-bark hickory in June, peeled the bark off, and although the sap wood was nothing but a powder the wood proper was not in the least affected. [Further information concerning the time for cutting and the mode of treatment for securing durability, can be found in a recent Forestry Bulletin issued by the U. S. Department of Agriculture.]

A WORD ABOUT WATER.

[BY DR. R. C. KEDZIE.]

In November and December just passed, I fully realized the fond dream of my life in a visit to the Pacific coast. I had called myself a westerner ever since my father had brought his young family to "the wilds of Michigan" in 1826, but in my new departure towards sunset I found I had to go west nearly 900 miles before I had reached the geographical center and first struck the borders of the real west. After reaching this pivotal center I still had to whirl along two thousand miles westward before I reached our Pacific border and stood beside "the golden gate." Our vast country! A man may rattle around inside it for weeks at railroad speed without crossing his track or reaching its border.

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I shall not bore you with the history of my journey, the places I saw or the wonders I encountered. I only glance over my trip from the standpoint of water in its influence on climate and production as seen at the far west.

The "rain-belt" of Kansas has plainly moved westward by 150 to 200 miles within the last 20 years, as is shown by the growth of towns of 2000 to 8000 inhabitants on the line of the Kansas Pacific R. R., within what was once "the arid belt." But upon all the region from Wakeeny to Denver—300 miles—the penumbra of the desert had fallen and clothed the agriculture of the country with the half shadow of a stock range. From Denver to Salt Lake we found the home of the irrigating ditch. At Ogden we came face to face with "the Great American Desert." The G. A. D. is a great fact, not to be marked out by a wave of the map-maker's pencil, or dismissed by a figure of rhetoric. From Ogden westward for 600 miles it stretches out its weary solitude; the gray soil, the sparsely scattered yellow-gray tufts of bunch grass, and the gray sage brush make the desolate landscape—gray, grim and ghastly—stretching away in endless perspective, or reaching to the solitary mountains that lift their heads here and there as if looking to see if the deliverer will ever come! Death and despair hold joint rule over this land. No hum of insect, nor foot of beast or wing of bird, save "three black crows," that forage up and down the railway track, to pickup the chance crumbs thrown out the car windows from the lunch baskets of tourists. Drouth is the sceptre by which death and despair rule this land. Gazing over these arid wastes, their gray lips seem to form the prayer of old, "Send Lazarus that he may dip the tip of his finger in water and cool my tongue."

If rain does fall, the water rushes off in destructive torrents, because there is nothing to hold the precious gift.

When we reached the Sierra Nevada Mountains all was changed; masses of snow, mountain streams, and lofty pines and firs tell of life and hope. The amount of snow on these mountains may be conjectured from the fact that in 90 miles of railway travel we rode through 40 miles of snowsheds. At the summit we found the snow deep on the mountain top in November and snow rapidly falling; yet in descending into the Sacramento Valley, in less than four hours we found ourselves in orange groves and blooming roses.

I pass by the beautiful rain-fed valleys of northern California—the Sacramento, Santa Clara, Livermore, San Joaquin. The world has heard of these wonderful wheat-fields of the Pacific slope, has opened her mouth wide in astonishment, and promptly had it filled with bread.

Three hundred miles southeast from San Francisco we struck the Mojave desert, which bears some resemblance to the Nevada desert, yet differs in important particulars. The shrubs are greener, the bunch grass brighter; and the grotesque cactus growth comes in to vary the scene. Yet the Great American and the Mojave deserts have strong points of resemblance.

Going southeast from Los Angeles into San Bernardino county I passed through a succession of beautiful villages, set in orange and apricot groves, and stretches of untamed desert till I reached my stopping point in Colton, where I found my old friend, the genial doctor, who years ago turned his back on South Haven, on the shore of Lake Michigan, to find *South Heaven* on the shore of the Pacific. Walking through his ample grounds, among orange groves drooping with their burden of fruit, lemons, limes, grapes whose clusters had been too abundant to harvest and had dried on the vines, peaches, apricots and figs, that had borne their crops and cast their leaves, eu-

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calyptus and pepper trees waving their evergreen leaves, the Japanese plum in full bloom for the next harvest, roses, geraniums and heliotropes loaded with blossoms, with humming birds flitting from flower to flower (though it was the middle of December), and the landscape all flooded with the warm sunshine of southern California; I asked the doctor how far south I would have to go before I struck the desert? "You are in the desert now! All this place was a desert of sage brush and cactus till that irrigating ditch brought in a supply of water, when 'the desert rejoiced and blossomed as the rose.'"

"If this was a desert," I replied, "pray tell me how Eden looked in comparison?" "Don't bother your head with the Eden that was, look around you and see how Paradise looks now!" And then he plucked a luscious orange and stopped my mouth therewith.

And then it began to dawn upon my benighted brain that the great American desert, the Mojave, and every other desert in our boundless west, are deserts mainly *from want of water*. The millions upon millions of acres in the great American desert can be changed into fruitful fields by an adequate supply of water. At one desert station water had been brought by pipes from the mountains five miles away, and by its use a lawn was made of grass as beautiful as Michigan in June—shrubs and trees as vigorous as heart could wish. The problem of the west is the supply of water.

Much has been said about the evils of "watered stock," but the only stock that declares a dividend in agriculture is *watered* stock. Even in our own rain-blessed peninsula the fruitful year is the season of abundant and well distributed rain. What was the cost to our State of the drouth of 1887? What sum will measure the loss in the Mississippi valley of this two months' drouth?

The suspicion is spreading widely that the climatic conditions controlling the seasonable distribution of rain throughout the older parts of our country are changing as the country is being cleared up; that the alternations of drouth and flood are becoming more pronounced year by year; that while the floods are more destructive, yet the water-line falls lower in the soil with the progressive improvement of the country. One class of writers aver that the removal of our forests is disturbing our climate, and another class, that tile draining is ruining our soil. I do not propose to discuss, much less settle these questions in the few minutes assigned me on this occasion.

While thus announcing in advance my disinclination to answer difficult questions, permit me the Scotchman's right to ask as many questions as I please. Let me, then, ask you whether the climate of our country is changing? Are the extremes of heat and cold, of drouth and flood greater or less than formerly? Do you farmers rely as confidently upon the uniformity of our seasons in the conditions relating to agricultural productions and the security of man and beast as in former years? I do not now allude to the dreadful reports we receive of suffering and death in Dakota and the new Northwest. We are only beginning an acquaintance with our young sister and her breezy ways. It may be that these blizzards have had for ages past their home in her wide domain, and winter by winter may yet hold their wild revels there for years to come. We have discovered a new State, and possibly a new state of the weather. Leaving what we will hope to be exceptional weather manifestations, I desire to turn your attention to those States that have been settled so long that we may assume to know something of their normal climate. Are the climatal extremes becoming more marked with

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the improvement of the country? the changes of temperature more sudden and violent? the rainfall more capricious in these older settled States? Have these changes in climate any connection with the deforesting of our country, or any other cause sufficient to account for a change?

Some one may reply that these questions of the climatal influence of forests have all been investigated with a thoroughness and completeness we may scarcely hope to emulate by scientists in Germany and France, and by Crumbie Brown in South Africa. I cheerfully concede the great value of these investigations made abroad and the use we should make of them in this country. But will researches on climate made in those countries be entirely applicable to the United States? Are not the climate and physical geography of America so unique as to demand original investigation to determine their peculiarities? Cast your eye on the map of the world and contrast the configuration of America and Europe. Stretch a line along the parallel 42° north latitude, from Boston to Cape Oxford. It will pass through Lake Erie and Michigan, but will be at its nearest point about 800 miles from Hudson's Bay on the north and the Mexican gulf on the south—the only off-shoots of oceanic water that penetrates our continent to a noble extent. Even the vast expanse of Hudson's Bay is frozen over for nearly eight months of the year, and contributes to the land climate instead of the sea climate.

Stretch the same line along the same parallel from western France, and it will pass through four seas of large size and finally lap over into Tartary, in Asia. Picture to yourselves the difference in climate over such immense reaches of country produced by such physical contrasts.

Note also the trend of the mountain ranges in Europe and America. With the exception of the Ural Mountains and the Scandinavian Alps, most of the mountain ranges of Europe run in a general direction east and west, so that the west and southwest winds normal to the temperate zone are not broken up and defiected by mountain ranges. In America nearly all the mountain ranges run north and south—the White and the Green Mts., the Alleghanies and the vast mountain system that we may group together as the Rockies. The normal wind system of this zone is seriously affected by the Alleghany and Cumberland Mountains, but as surface or climatal winds they are broken up by the Rocky Mountain chains.

By reason then of its continental mass, almost unbroken by incursions of the sea, and by the meridianal trend of its mountain chains, we can see that our country must have a climate peculiar to itself, demanding study and investigation separate from the systems of the Old World.

Did you ever think of the fact that the capital cities of all the great nations of the world all lie north of 40° N. Lat., except Washington? Madrid, Paris, Berlin, Rome, Vienna, Constantinople and Pekin lie north of 40 deg., while Washington is about 39 deg. N. Lat., the most southern capital city of the great nations of the earth.

We usually think of Rome, with her figs, olives, oranges, etc., as having a semi-tropical position like Savannah and New Orleans; but the southern tier of counties in Michigan have the same latitude as Rome.

But when we turn our attention to the position and surroundings of our peninsula, we are satisfied that nature chose this spot for some peculiar manifestation of her favors, and when she threw the arms of her encircling lakes in a loving hug about our peninsula she meant business! Looking at the unique position of our State, no thoughtful person will doubt that the

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meteorological conditions here demand a separate and careful study irrespective of the general climatal conditions prevailing elsewhere. No generalized discussion will meet our condition as a State.

In this paper I desire to say *a word about water* which shall remind us of its deep significance—that a well-distributed water supply is of the greatest importance to every human being—to every one who eats food, wears clothes, lives in a home or travels by the way, or who seeks to shield himself from the burning heat of summer or the icy blast of winter.

This first Michigan Forestry Convention is a fact full of significance. In its widest scope it includes not alone the lumberman and the wood-chopper. Timber and fuel are only leading features for consideration, and there are other topics of equal importance. It is not merely the dead tree to supply present wants, or the growing tree as a future supply, but it is the *living tree as a living thing* that demands our consideration—its relation to our present condition and its influence on the future well-being of the State. What are the relations of forests to rainfall? to soil-water? to crops? to the public health? What will be the influence of deforesting in these various particulars? We can gather a large harvest of opinions, guesses, suggestions and views on all these subjects. But what do we *absolutely know about any of them?*

In these questions about the relation of forests to climate we want *facts*, not *fancies*—facts strong as granite and changeless as the sun, so that when we build up our theory, and call it a science, we shall not have to "lay again the foundation of repentance from dead works." With fancies we may inflate a beautiful cloud that will soon fade into thin air, but with facts we may build a pyramid that will bide for aye. Have we now such facts on this subject? Who can tell us for certain the real difference between the air in a forest and that in an open field on a summer day?

Years ago I had a long talk with the late Franklin Hough on the desirability of this knowledge, and I promised to make investigation on this subject the next summer. As a preparatory investigation during the winter I began some observations on the comparative temperature in the heart of a living tree and a dead tree, and how both were related to the temperature of the air in the forest. I followed up my observations for several weeks with interesting results coming into view. But my path through the snow made in my daily round of observations aroused the curiosity of some vagabond who followed my track, stole all my thermometers and brought my investigation to an abrupt close. I lost my thermometers and found my temper, but for a time my ardor in scientific research was cooled. The result was that forest air has been left to run loose ever since, and the promise I made Franklin Hough ten years ago is unfulfilled.

Leaving this narrow line of inquiry, permit me to say that the whole subject of the relation of forests to meteorology is one of great interest, and would seem to be one of vast importance to our people. If there is a casual relation between forest area and climate, and if there is danger that we may ignorantly disturb the harmonious relation of field to forest, it is time to pause and enquire before the time of safety is overpast. It may seem that the thermometer, the psychrometer and the rain gauge are feeble instrumentalities by which to fix the line of policy of a great State, yet the fall of an apple revealed the law of gravitation and turned human thought into new channels.

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It seems that we are now in just the position to take up and investigate these questions of overshadowing importance to our people. Thanks to our far-seeing State government, we have a Forestry Commission and a State Weather Service, the very organizations to carry forward such an investigation, and, by singular good fortune, both organizations are under the direction of the same board. And Michigan is just the one to lead the van of States in this, as she has in so many other new lines of work.

Mr. Slayton: Did the Doctor note any effects from timber plantations in the west?

Dr. Kedzie: I did not get among any considerable plantations. Those that I did see were cottonwood wind-breaks and groves of eucalyptus in California.

Mr. Glidden: I understood Dr. Kedzie to say population has extended two hundred miles beyond the edge of the prairies. Did he note any influence on rainfall from this extension of plowing, irrigation and tree planting?

Dr. Kedzie: I think the irrigating ditches of Colorado are influencing the meteorology of Kansas.

Col. Fox: Is there any danger of getting too much forest? The Kalamazoo Board of Health ordered many of the shade trees cut down, as they believed it had an injurious effect on the health of the community.

Dr. Kedzie: There is danger in shading houses. A shady house that gets mouldy will put the human occupants into the mould.

Mr. Fernow: Have you statistics showing an increase in rainfall?

Dr. Kedzie: No.

Mr. Fernow: Figures show little or no increase, and yet there is an amount now sufficient for agricultural purposes, if it can be made available.

Mr. Monroe: Did you get any results from your observations on the temperature?

Dr. Kedzie: No.

Mr. Fernow: Foreign investigations show the general effect of forest areas on temperature, but not for restricted localities.

Pres. Willits: The question as to the policy for the mid-continents is a fascinating one. I asked Maj. Powell if he thought the desert areas in the West could be redeemed by tree planting. He said *no* positively, and he still sticks to that opinion. He says the great source of water supply for that region is the Pacific, and that the Rockies comb the moisture out of the clouds as they pass up the western slope, and no amount of tree planting will get moisture out of the dried air that is left. There will be no increase of rainfall unless it comes from the east or south. I noticed that as you go west, rising four thousand feet to the great desert and then pass on up the Sierras, you only strike verdure when you pass the divide. So as you return by the southern route all is fertile till you strike the eastern slope, and there it is a desert, a mass of boulders looking as though a freshet had flooded it a week before, though in fact no rain had fallen for ages. You continue on east a thousand miles before you strike vegetation of any note, and it is my opinion that is the limit of the rain supply from the east. Mr. Dorsey in the North America Review says: "It is all nonsense to attribute to added culture increase in rainfall." A graduate from our institution located in western Nebraska says: "Powell and Dorsey to the contrary notwithstanding, I *know* the rainfall has materially increased, and

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Indians making sugar in Crawford county. Three women boys are playing in the foreground.

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the fact is entirely unquestioned in Nebraska." They have planted several million acres and they feel convinced that it has increased their rainfall. They plant first the quick-growing soft woods, and later follow with hard woods. It seems to me the Nebraska rain supply must be from the east and south. They have winds from those directions, as their cyclones testify. By judicious tree planting they have induced those winds to part with their vapor-laden masses, and behold the result! Congress has been asked to build reservoirs up in the mountains so that they might in this way get a water supply. They had better take the money they propose using for masonry and plant trees.

Mr. Hathaway: Forests serve to distribute rainfall more evenly, and I think this is one reason why we may have more fertility without any increase in rainfall.

Mr. Fernow: Maj. Powell and Prof. Sargent likewise are riding hobbies. They depend too much on averages, and averages are not what affects the farmer. An open cultivated soil and forest area facilitate the deposit of rain in certain localities. If the government would preserve the reservoirs (forest covered mountains) she now has, she would need no brick and mortar for such purposes.

THE SUGAR MAPLE IN ITS RELATION TO THE FORESTRY QUESTION.

[BY EUGENE DAVENPORT, WOODLAND, MICH.]

I am here to say a good word for the sugar maple. I believe, and it will be the purpose of this paper to show, that, within the maple belt, no other tree lays equal claims to the attention of those interested in the preservation of our forests, nor offers so good and economical means for the accomplishment of that purpose. To this end I shall endeavor to show: First, that the sugar maple fills all desirable conditions for Forestry purposes better than does any other tree; second, that, everything considered, the maple sugar industry pays a better profit than does any other ordinary farm enterprise; third, that it may be considered in the light of a permanent investment, and that by virtue of this tree our forests within the maple belt may be rendered sources of revenue for all time—the most certain means to their preservation.

Should I be so successful as to establish these points as facts, and be able to show how this tree may be perpetuated from generation to generation, not to the exclusion or detriment of other species, and with no loss to the owner, but with constant profit, I shall feel that I have done no more than justice to my friend, and that I have only established her just, rightful claims to your attention. I invite your consideration of these questions.

It is evident from the standpoint, both of public economy and of private enterprise, that the trees that should receive our fostering care are the ones that will sometime yield a revenue to the owner. Trees whose timber is valuable or that yield valuable products exert fully as well as do worthless ones the beneficial effects on soil and climate. So far as forest perpetuation looks to the preservation of the timber supply the timber trees are alone concerned, and the maple is not a valuable one. But it is manifest that for Forestry purposes proper, where the preservation of living forests is the desideratum, those trees are most valuable that yield a revenue without the loss of the tree itself.

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Timber trees declare a dividend only at death, and there is a constant and strong temptation to their destruction. The nut-bearing and sugar-yielding trees declare annual dividends, and the tree survives. The owner sees in them a perpetual source of money, and there is strong reason for their preservation. To this end the nut-bearing trees have been recommended in the hope of enlisting individual sympathy through the medium of the pocket-book. Two difficulties are apparent. The nut-bearing trees flourish over a wide range of territory, and there is some danger of over production. But, worst of all, as a rule, the timber of nut-bearing trees is valuable, and there is a constant temptation to sacrifice future welfare to present needs—in other words, to kill the hen that lays the golden eggs. With the sugar maple this danger is reduced to the minimum. Of all trees yielding valuable products its timber is worth the least in the markets, its annual dividends are high, and there is no danger of over production. It possesses the prime requisites for Forestry purposes, viz: A valuable product and a timber of little market value. Its life is about as secure as that of a valuable tree can be. This product of the sugar maple is one of the choicest table luxuries, and only needs to be known in its purity to be appreciated.

Sucrose, or cane sugar, is produced by a variety of plants and trees, each imparting its own peculiar flavor to the product. The most delicious and delicate of all is that of the maple. It may almost be called an aroma, and maple syrup, if so made as not to destroy this quality, possesses a value as a luxury far above that of its mere sweetening powers. Its manufacture is a paying industry, and, as I have been requested to dwell upon the profits arising therefrom, I will enter somewhat into details.

Various conditions affect the net proceeds of the business, most of them being within the control of the manufacturer. If the product be carelessly made, so that the true maple flavor is disguised or destroyed, it is valuable only to the extent of its sweetening powers, which is usually less than that of granulated sugar, as the same ill-treatment that destroyed its flavor would convert a portion into glucose, which is only two-fifths as sweet as cane sugar. As no gain is realized in any way by making an inferior article, the profits are usually in proportion to the quality; for that is the one factor above all others that regulates the market price. Other considerations have a bearing on the profits; as a retail trade is better than a wholesale, and a large bush can, in general, be managed more economically than a small one. No labor or expense necessary to producing the best article must be spared, but in no business do the little savings tell more on the balance sheet. A quart in a pail from one thousand trees will make from six to ten gallons of syrup. In brief, the profits depend largely on the man.

I cannot give a truer idea of the industry than by giving actual figures and estimates from our own business. I do this because it affords the best data known to me. I disclaim all desire to air my own affairs, but I have no secrets to withhold, and I consider our profits a fair average of what may be reasonably expected with the same care and attention that are necessary to success in any business.

We tap one thousand trees which are scattered over forty acres of land. It is by no means a choice piece of timber, as the same number might, and often do, stand on twenty acres. Besides the land our cash investment is about $750.00, divided as follows:

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1000 tin pails @ 25 cts	$250 00
2000 Post's spiles @ 3½ cts	70 00
Sugar house with tank	150 00
2 evaporators	250 00
Miscellaneous	30 00
Total	$750 00

Our annual product sells for from $350.00 to $500.00, with an average of about $400.00, from which we deduct expenses as follows:

Labor, fuel, etc	$100 00
Wear of apparatus	15 00
Interest on $750.00 @ 6 per cent	45 00
Total cost of manufacture	$160 00

This leaves an average annual net profit of $240.00. I make no deduction for taxes, as I consider them off-set by the value of the land for pasture and of the timber for fire-wood. As all expenses have been deducted, the $240 may be considered as the income from an investment in forty acres of maple timber, which is six per cent. on the value of the land at $100.00 per acre. This is above its market value. If the money value of the land be $50.00 per acre, the investment yields a dividend of twelve per cent. This is a net profit of twenty-four cents for each tree, and every maple tree thus represents a money value of $4.00 for sugar purposes. This is reckoned on the basis of syrup at one dollar per gallon.

These may seem small figures, but we must consider that the business needs at the longest about six weeks' supervision in the year, with less than four weeks of actual work, and that at a time when men and teams are not employed to advantage upon the farm. Bear in mind, also, that this is done upon land that costs nothing besides the original purchase money, without clearing, draining or improving.

In the light of these facts, are not the results most gratifying? What other farm product with so little outlay of time, labor and money will pay twelve per cent. on the actual value of the land? Years ago, when land was cheap, these same thousand trees I have been speaking of paid in *one season* for eighty acres of land, or twice the land they stood upon. This is slightly better than twelve per cent. Did any farm crop ever pay in one year for double the land it grew upon? Is not the maple truly the rich man's luxury and the poor man's friend? Considering that if thickly wooded, as is often the case, our income might all be realized from twenty acres, or even less, instead of forty, am I not right in saying, as I have often done, that for making money I would rather have a farm covered as it *might* be with maple timber than to own the same land in the highest state of cultivation!

I would not be understood to say that these figures are realized by any great proportion of our Michigan sugar makers. In older states they are duplicated. But in Michigan we are yet in the transition state; too many make their sugar *a la Indian*, and invariably they maintain that "sugar making does not pay." I will give a fair statement of how such a man conducts the business. Instead of investing liberally in the best apparatus, he sets up in business for one thousand trees about as follows:

1000 pails, wooden and leaky, @ 15c	$150 00
2000 spiles, tin	25 00
Pans	50 00
Miscellaneous	25 00
Total investment	$250 00

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He will be fortunate if he makes three hundred gallons that will sell at sixty cents per gallon, or $180.00. His expenses will be nearly the same as ours, and will be about as follows:

Labor, fuel, etc	$100 00
Wear on apparatus	10 00
Interest on $250.00 at 6 per cent	15 00
Total cost of manufacture	$125 00

This sum deducted from his gross income leaves net proceeds to the magnificent sum of $55.00, which is five and one half cents per tree, or two and three-fourths per cent. on his land valued at $50.00 per acre, and indicates an actual value of only $23.00 per acre. He has saved the investment of $500.00 —a yearly gain of $30.00 in interest—and loses $185.00 by making an inferior grade. His trees are worth less than one dollar apiece, considered as a permanent investment. I dislike to present this side of the subject, but it is the fault of the man and not of the tree. We are rapidly rising out of the rut, and I could picture a state of things as much above our own business as this is below, and it would be equally true. Professor Cook of our own State sells his first quality syrup at one dollar and twenty-five cents a gallon, and W. I. Chamberlain at one dollar and fifty. We cannot fill our orders at one dollar, and what shall we do? I believe I am more than fair when I offer our own business as a fair average sample of what the business ought to be and *will* be in the near future.

A question pertinent in this connection is how *permanent* will this investment be? Now, as long as there are human beings to make maple syrup and sugar there will be other human beings to eat it. The demand is growing and the supply will necessarily always be limited. We are the greatest sweet-eating people in the world, and use fifty-six pounds per capita every year, exclusive of glucose and honey. The area of maple production is pretty fully developed, and not enough is made, including enormous adulterations, to afford a pound a year to each inhabitant. If all of it were made into syrup there would not be one half a gallon to every family of six. Less than one-half of one per cent. of the world's supply of sugar is reported as maple. This in face of the fact than one county in Ohio is said to have reported a yield of fifty pounds per tree, and that they are probably busy in Chicago to-day making maple sugar. Add to all this the fact that the supply of genuine maple is decreasing and that of mouths rapidly increasing, and the question arises, "Wherewithal shall our griddle cakes be sweetened?"

The appetite is cumulative, and what was once a luxury rapidly comes to be considered a necessity. It is cheap dessert at one dollar or even at one dollar and fifty cents a gallon. Orders that began years ago at one and two gallons have grown to five and ten. The neighbors and friends, too, catch the appetite, and their souls yearn for maple. A few years ago we filled an order of two gallons from a little town in this State. Last year it took one hundred gallons to sweeten that same little community. There is an inherent quality in *good* maple syrup that will sell itself. Nothing but honey can ever compete against maple sweet, and there is no real competition between them. They are both sweet but have no other property in common. Neither is used for the sweet alone.

No industry rests upon greater promise of permanence. It supplies a luxury; hence will always command a fair price. The luxury is within the reach of all; hence the demand will be great. Natural causes limit the possibility

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of production; hence there is little danger of over production. The demand is increasing; hence the price will tend to rise and not to fall.

With proper care the apparatus required for its manufacture is very durable, and the only practical limit to the permanence of the business is the tree. All things must end, and our maple trees are gradually yielding to the inevitable. This is not necessarily owing, however, to the injurious effects of tapping. As a rule our sugar bushes in Michigan are made up of the original forest trees preserved for the purpose. Many of them have reached the limit of their lifetime, and their death and decay are but natural processes. No tree accustomed to the shelter of the forest will long survive after its companions are cleared away. Our sugar bushes stand in small isolated areas exposed to the full effect of wind and weather. These two causes—old age and exposure—and not tapping, are to be assigned as the true causes for the loss of our sugar trees. If the number is growing less it is mainly because of the hitherto reckless disregard of the second growth, with which nature strives to supply natural losses. The number may for a time decrease, but already sugar makers are awaking to the necessity of preserving and encouraging this second growth.

Nature practices a rotation of trees. Varieties are not scattered promiscuously among one another, but exist in groups mainly of one species, to the practical exclusion of others. In other words, the undergrowth is never of the same species as the large timber. The undergrowth upon beech ridges and elm lowlands is mainly maple. These, if preserved, will eventually become our sugar bushes. Within my own recollection this principle rotation has removed the bush from some areas, and it has entered upon entirely new ones.

It is noticeable that this second generation of trees, growing up accustomed to all the vicissitudes of the climate, are more stocky than the old forest trees, have larger tops, and appear to sustain no injury from tapping. In older States the bushes consist of this kind of trees, and give promise of indefinite endurance. Tapping is not a severe drain upon the tree. It removes but about one-sixteenth of its stored nutriment at the most, and while it may slightly retard the growth it is no enemy to the life of the tree. We are to look with great expectation then to this second generation of trees, and the question for us to consider is *how best to assist nature in her efforts.*

Many will say it takes too long a time to grow a sugar bush. It will not pay. True it does take time, but do as our old friend Josh Billings used to advise, and "set them out a good while ago." It takes time to raise an orchard of fruit trees. Nature has favored us, let us provide for posterity. Neither does it take so long a time as we might suppose. Groves of maple that within my recollection were small trees are now tapped. I knew one tree by the roadside that forty years ago was a little switch preserved by one of the early settlers. It is now eighteen inches in diameter, and has a beautiful top forty feet across. Trees along our place, set twenty years ago, are nearly large enough for tapping, and they have been all the time in a June grass sod. Thirty-eight years ago in a township adjoining my own, ten acres of oak were girdled and left to fall down and rot upon the ground. From that day to this nature has had her way in that old slashing. She set about covering the disgrace. The winds scattered those little winged seeds among the rotting logs, and to-day the ground is covered with a dense grove of maples with scarcely a tree of any other species. It is said that over three

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thousand thrifty maples now stand on that ten acres, many of them large enough for tapping. I would rather have that ten acres of maple grove than any twenty acres of farm land in Barry county. These instances show what maple trees will do without care, and under circumstances when even apple trees would make but a sickly growth or none at all.

What other farm product is there upon which the producer can fix the price, and of which there is so little danger of over production? I would not give the government a sweetened griddle cake for a tariff on maple sugar. While the orchardist is perplexed over changing the bearing year, renovating old trees, and fighting insect enemies; while the wheat yield grows less and less, and stock are eating their heads off, and a full supply means a low price, the maple works steadily on unattended till the spring time, when we reap its harvest with no perplexity as to the relation between supply and demand.

The nut bearing trees are but an uncertain source of income. The timber trees yield a revenue but once. The maple declares annual dividends on a permanent investment, never waters the stock, and never runs away to Canada. When no longer useful or ornamental it "gives its body to be burned"—a good will offering to human kind.

While nature makes noble efforts to perpetuate this tree, shall we not assist her? I believe that planting ought to be done in all available places, as roadsides, lanes, borders, open places in timber, waste places, among large timber of other kinds, and perhaps even old and worn out fields are often worth more to plant to trees than to cultivate at a loss. In many sections the pasture from such a field while the trees are growing would be worth no inconsiderable sum. The maple will thrive on almost all varieties of soil, from the lightest sand to the stiffest clay, failing only on lands that are low and wet.

In all this I believe everything should be done in accordance with the natural principle of rotation. If everything be planted to maple now, there will come a time when maples will not grow. Maple after maple is, like wheat after wheat, a failure. I am speaking now of those sections where climatic changes render sugar making a profitable industry. Plant other trees among the older maples. and let certain acres be planted exclusively to other kinds. Then will the principle of rotation be provided for, future planting ground will be insured, and our children's children can plant maples as well as we.

What steps should be taken to enlist public effort; what the State can do, if anything; what forestry commissions and associations can accomplish and how, are questions not the province of this paper to discuss. But whatever is done in the forestry question must be accomplished by aid of popular interest and individual effort. The interest of the *individual* as well as of the public must be appealed to. The public, and especially the producers need to be aroused to the advantages of the sugar industry, and educated in the methods of producing the best article, and in the principles of forestry preservation. In this connection I believe that the true merits of the sugar maple need only to be appreciated for it to become the agent whereby the forests of this section shall be perpetuated, and become in the meantime, not a loss but a paying investment.

Query: What per cent of the sugar used in the United States is maple?

Mr. Davenport: I cannot say. The census for 1883 gives 37,000,000 pounds as the amount produced in the country.

Mr. Fernow: The census for 1882 gives 3,000,000 pounds as Michigan's product, and for 1884 it gives 2,000,000 pounds. Why this difference?

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Mr. Davenport. I think it is merely due to the incidental variation of trees one year with another.

Query: Is soft maple good for sugar?

Mr. Davenport: The soft maple sap is too thin to boil profitably.

Mr. Fralick: I think the low production of maple sugar in any given year is due to the low price of granulated sugar. When granulated sugar is cheap many bushes are not worked.

Mr. Cook: I think Mr. Davenport underestimates the timber value of the maple. The maple works into good flooring. It furnishes three-fourths of the axletrees for lumber wagons, and is a good cabinet wood. As a shade tree it is very valuable.

Mr. Davenport: The timber value is not much realized by the grower. It yields but one or two logs and is very heavy to transport.

Query: Is the sugar maple easily transplanted to sandy soil?

Answer: Yes.

Mr. Slayton: At Whitehall, where both the soil and sub-soil are sand, there is an abundance of sugar maples. There are over 3,000 thrifty maples in the village.

Mr. Glidden: Several years ago David Woodman of Paw Paw, went into the woods one morning, hitched a chain around some maple saplings, snaked them out with an ox team, planted them in the afternoon, and to-day they are as thrifty as any transplanted trees I ever saw.

Mr. Davenport: My experience is that the lighter the soil on which the trees grow the lighter will be the sugar. Sugar produced from trees on a gravelly soil is of better quality than that from sandy loam, and that is better than sugar from a clay soil.

Mr. Coffinberry: Ten miles south of Grand Rapids there is a section of country that twenty-five years ago had a rich alluvial soil. That has been gradually worn out, exposing a light soil with pine knots in it.

Mr. Rose: In the spring of 1863 I planted fifteen maples on the sandy soil of Big Rapids. I dug them in the morning with plenty of roots and set them out in the afternoon in big holes, with the roots well spread out. I mulched with pine sawdust, and gave them a pailful of water twice a week. They were small trees from a wind-break but were accustomed to plenty of sunlight. At present they are from twelve to eighteen inches in diameter three feet from the ground. The Grand Traverse region produces as fine maple trees as there are in the world. They will average four twelve foot logs each, and are most valuable for timber.

The afternoon session opened with a paper entitled

HOW TO MANAGE THE RESERVE FARM WOOD-LOT.

[BY A. C. GLIDDEN, PAW PAW, MICH.]

The consideration of the strict letter of my topic leaves but little for me to say, for there are no peculiar or difficult methods to learn—no special system to follow. The handling of the reserve farm wood-lot, then, may well be left to the "horse sense" of every individual who has the acquisitiveness required to own one. Every farmer has learned that young plants or young animals will not thrive in the flocks or in the shade of the older ones. So he takes

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the old sheep from among the lambs and the old trees from the wood-lot, and gives each an equal chance to grow. I have never known but one farmer so forsaken of his better judgment as to cut out the young timber and leave the mature trees standing. But around this question of the reserve farm wood-lot more than half the questions in your scheme of topics converge. How many acres in every hundred are required to be left in timber for the several uses of the farmer for a permanent or perpetual supply? Will the number of acres thus required be a sufficient per cent. of the whole area to satisfy those who assert that, to preserve the normal climatic conditions, an equilibrium must be maintained between shaded earth and sunny skies? If it is decided by farmers themselves that 15 acres in every 100 left in timber is a sufficient amount, and on the other hand the pessimistic opinion prevails largely that dire climatic ills await us, unless 25 per cent of the land in farms be kept in forest reserves, who is to compensate the farmer for the ten acres of idle land, on which he must pay taxes, while the experiment goes on to test the accuracy of this prophecy of evil? Suppose again that the opinion spreads, as it certainly prevails to a large extent now among farmers, that fuel and timber can be purchased cheaper than to keep any land at all for a wood-lot, and they prefer a shelter belt about their dwellings and barns to one half a mile distant, "what are you going to do about it?" Can you here formulate a series of arguments that will prevail against the solid facts which he will present in favor of his side of the controversy? How many farmers can you find who would be willing to cede ten acres of land over to the person who would obligate himself to provide a perpetual supply of fuel and timber for the ordinary uses of the farm? If he would not do this, how can you expect to prevail upon him to set apart twenty-five acres out of every 100 for such a purpose?

I have thus far stated the practical and difficult side of this question—hence reiterated the arguments that confront us on investigation among farmers, yet there is a provisory side of the case—a sentimental aspect, if you please—which has a tendency to restrain the suicidal ax, and to conserve and stimulate the growth of young timber. There are on many farms accidental patches of young oak timber, left in bushes when the adjoining land was cleared, which have all at once assumed the character of the farm wood-lot, and around this once despised corner of the farm, cluster all the hopes of its future timber supply. The ordinary stock arguments about the value of the land in crops against its timber value, have no influence over the owner to convert it into a plowed field. The trees are from 30 to 60 feet high, and from 6 to 10 inches in diameter, and have reached these dimensions in 30 to 50 years. Ten acres of such timber would now give a constant supply of fuel from the necessary thinnings, for the use of a large farm, and furnish the frames for all the necessary buildings that will be required in the future. The timber itself is much better in quality than the original growth, and is growing into fine, tall, straight trees. This timber has grown on neglected tracts, three to ten acres in extent—is a sort of spontaneous gift, which cannot be duplicated or further extended by artificial means, without such an outlay, probably, as will thwart any effort in this direction.

That species of philanthropy which prompts the sacrifice of present possession for the possible good of posterity is a very rare virtue, especially among land owners, to whom you look as the only ones to practice these suggestions of public economy. There is a sort of sublime faith in the future, fostered

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by the experiences of the last 25 years, which loosens its hold of the indispensable conveniences of the past, and reaches out into the future with an almost prophetic assurance of being abundantly supplied. I apprehend you will find it extremely difficult to get farmers and land owners to make, unaided, efforts at reforesting any portion of their possessions. The fact is apparent that opinion regarding the value of the farm wood lot is rapidly changing, and not in the direction which this meeting can approve. Groves of mature timber are being rapidly cut down, which were not long since venerated almost as much as that which Abraham planted in Beersheba, in the long ago, as a place for worship. This timber has reached a point where growth has ceased in a large measure and decay has begun. The demand and price of oak timber has been rapidly declining for several years, and the farm wood lot has not become the bonanza promised 20 years ago.

I am aware that the motives which prompt the action here outlined in farming communities are purely selfish. They ignore this individual action, which, comprehended as a whole, creates a degree of apprehension in the minds of many people that this destruction of the original forest will bring on us and over us, climatic disasters and disturbances, the dire effects of which can only be prevented by planting many fields again to forest trees. So far these ominous predictions have had no weight in restraining the ax at the root of the tree. The farm wood lot and the reserve timber lot will stand or fall, from considerations of evidence more palpable than these. If the wisdom of the few is to control the actions of the many, the argument for replanting must be predicated upon a more substantial basis. It must be shown that present or prospective profit will certainly attend the enterprise, or the whole matter must be relegated to the management of experiment stations, to test the expediency of the project.

Benj. Hathaway: I think there has been in the past few years an appreciation in the value of oak timber.

Mr. Glidden: Fifteen years ago we received 28 cents per tie. Three years ago the price increased to 50 cents, now we get 75 cents apiece.

Mr. Hannah: Ash is lower than it was. Manufacturers have found other timbers to take its place. Hardwoods are even replacing pine to such an extent that pine is cheaper than it was five years ago.

Mr. Fernow: The opening of new forest areas by the railroads has much to do with cheapening lumber.

Mr. Fralick: The price of oak timber is on the advance rather than the decline. In Grand Rapids much is being used for furniture. It is used for railroad cars also, and the demand is increasing.

Dr. Beal being called away at this point, Hon. C. J. Monroe was called to the chair, and presided to the close of the convention.

Mr. Fernow: A few months ago I received a letter from England saying their supply of white oak had for some time been obtained in Arkansas, but that it is rapidly failing, and they were looking for other sources.

Mr. Hathaway: I can sell the oak on my land now for much more than I could a few years ago.

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WINDBREAKS FOR THE FRUIT-GROWER.

[BY PROF. L. H. BAILEY.]

There is greater difficulty in the growing of fruit in Michigan now than formerly. This difficulty is due mostly to deforestation. There are other reasons why fruit-culture is attended with increasing difficulties: 1. The increase of insect enemies, which come largely from wild plants to feed upon the orchards and gardens. With the destruction of their natural food supplies insects are driven to cultivated plants, upon which they usually multiply with great rapidity. 2. The exhaustion of the soil to a greater or less extent in some portions. 3. In many cases the cultivation of tender varieties. As a rule it is probably true that our highly developed varieties are not able to withstand so many unfavorable conditions as are "natural" or so-called seedling fruits. The susceptibility of the finest varieties to untoward circumstances is usually increased by the forcing operations of high culture; or, at least, such trees are shorter-lived. 4. Orchards are becoming old, and they are therefore less vigorous and less productive than formerly. There is reason to believe that in many places were apple growing, at least, is unprofitable, a remunerative industry could be inaugurated by planting new orchards. 5. In general it may be said that any difficulty in the culture of fruits is more closely observed now than formerly, from the fact that the crop is more valuable and receives more care. Hence the difficulties may be largely exaggerated in many instances, and wholly unintentionally.

Forest aids the fruit-grower in two important respects: 1. It prevents the disastrous effects of sweeping winds. 2. It conserves and regulates atmospheric moisture. It is very doubtful if the extremes of temperature or fluctuations in annual means are more intense in Michigan in recent years from the effects of forest removal. It may not even be true that there are more high winds now than formerly, but it is true that winds sweep over the farm with greater force. Winds sweep the surface and bear away the moisture of the soil at the same time that they come in contact with the trees and bushes themselves. The effect of the windbreak is to check the force of winds in prescribed areas. It has a local influence. Therefore we say that:

1. *In general a windbreak presents a great advantage to the fruit-grower.* A windbreak planted without any study of the conditions to be remedied may prove a deteriment. There are several important points to be considered in reference to kinds of trees as well as to general environment. It is important that:

2. *The windbreak should not obstruct atmospheric drainage.* Cold air is heavier than warm air and settles into the lower areas. This fact explains why elevated areas are warmer in still weather. Inasmuch as these highlands are more windswept than lower ones, it has become a common impression that wind is in some manner a protection to orchards, whereas the real protection comes from the atmospheric drainage. The windbreak upon elevated tracts, therefore, should be open enough to allow of the free drainage of air. In such locations a tight wall of evergreens is apt to be positively injurious. Deciduous trees, with, perhaps, a few evergreens intermixed, make desirable windbreaks. It should be borne in mind that it is not the object of the windbreak to stop the wind, but rather to check it, break its force; hence, a row of deciduous trees is often as satisfactory as a row of evergreens and decidu-

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ous trees. Some of the most satisfactory breakwaters are made of a network of naked piles rather than a solid wall.

In many interior localities a dense windbreak on the north and west excites an early growth in tender fruits, and thereby increases danger from late frosts. Hence

3. *The windbreak should never be dense enough to force the buds on fruit trees in those localities which are subject to late spring frosts.* It is evident, therefore, that spruces and other evergreens should be planted sparingly in such localities, and that deciduous trees which leaf out late in spring should be chosen for the windbreak.

One of the most disastrous effects of winds in the orchard and especially in small fruit plantations is the sweeping of the surface of the ground, causing excessive evaporation, carrying off the snow, thereby exposing the roots and crowns of the plants to untoward conditions. Therefore it may be regarded that

4. *As a rule, in localities where atmospheric drainage will not be seriously checked, the windbreak should have a comparatively dense bottom, formed by undergrowth or low-branching trees.*

All crops closely adjoining the windbreak suffer for lack of moisture and food supply, and many small plants, as bush fruits and nursery stock, are broken by the drifts of snow held by the windbreak. Hence

5. *So far as practicable the windbreak should be planted at a distance of six rods or more from the fruit plantation.*

In our severe climate only the most hearty and vigorous trees should be encouraged, and it may therefore be said that

6. *Native trees are preferable for windbreaks.* Of exotic trees, the Norway spruce, Austrian and Scotch pines, and apple alone are desirable for windbreaks in Michigan.

Mr. Baur: What is the influence of a forest near an orchard on insect pests?

Prof. Bailey: I should not plant wild plums or cherries on that score.

Mr. Sessions: How about sheltering peaches?

Prof. Bailey: I would protect them, yet at the same time that protection may be so placed as to injure the orchard.

Mr. Cook: North of us on rising hills near Rockford are extensive peach orchards, and wherever dense windbreaks on the west shut off free circulation of air so as to interfere with air drainage they were all killed, whereas, in every case where they were unsheltered or sheltered on the east, they were all right.

Mr. Hathaway: Is there any difference in the depredations of insects in sheltered and unsheltered orchards?

Prof. Bailey: I do not know. I have had no experience.

Mr. Baur: A neighbor's woods on the west of my pear orchard was removed, and since that the pears have been affected more than before. I don't know whether it was the birds in the woods or that the insects did not like the woods that caused the difference.

Mr. Sessions: In 1882, I set one thousand fruit trees. Three hundred were set eighteen rods from the woods. In 1883 and 1884, two hundred and fifty of the latter were killed, while not one of the former, amongst which the wind had free play, was injured.

Mr. Baur: I think forests prevent the spread of insects.

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Mr. Garfield: One may say, what a delighful place! Another, what a miserable situation! The one having come from before, the other from behind. So with this peach question; it depends on the kind of winters we have to meet. It seems to me that we need a break that will sift the wind, not stop it.

Mr. Glidden: A break is better than a forest.

Mr. Garfield: Yes.

Mr. Cook: There is no safety for peaches in elevations without *air drainage*. High flat land is no better than low land, if it lacks this.

Mr. Hathaway: Apple orchards planted near forests generally suffer from an insect that affects the fruit similar to a plum curculio. Hence I would not advise planting apple trees near a forest.

I have raspberries in an open field, and also near the woods. The former are killed much oftener than the latter. My land is undulating, and that may have something to do with it.

THE FUEL QUESTION.

Mr. Fernow: Perhaps it is not known that more wood (seventeen and one-half billion cubic feet) is annually used for fuel than all other purposes, there being only a yearly consumption of twenty billion. It seems to me there must be relief from this enormous consumption in the use of coal. In Germany, during the past twenty-five years, the consumption of coal has increased two hundred and sixty per cent, while that of wood has increased two hundred and three per cent.

Mr. Fralick: The large increase in the use of fuel in our country, is largely due to the increase in manufacturing interests.

Mr. Cook: There is a good substitute for wood in coal oil and its products.

Mr. Fernow: I am sorry we use so much wood for fuel as against so little for other purposes, yet I regret we don't burn *more* wood, *i. e.* tops, etc., that we now waste.

Evening Session of the Second Day.

Hon. C. J. Monroe in the chair.

The report of the committee on credentials was completed and adopted.

SHOULD THE STATE HAVE ONE OR MORE FORESTRY RESERVES.

[HON. C. W. GARFIELD, GRAND RAPIDS.]

Since the organization of the commission, I have felt that if it could crystalize but just one thing, and that, to set aside and preserve from vandalism an area of native forest, it would have justified its existence.

A generation ago, forest areas could have been reserved at the head waters of the Grand, Raisin, Kalamazoo and Huron rivers which would have afforded an object lesson of the greatest value to our people.

The more we cultivate out the vegetable matter from the soil, that serves as a sponge, the more suddenly the waters of a rainfall are lost to the land.

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Had such reserves been kept, the presence of perpetual reservoirs in the southern part of our State would be a manifold blessing.

It can still be done at the head waters of the Muskegon and Au Sable rivers.

Take six townships, including Houghton and Higgins lakes, that are almost worthless for agriculture, and they will make under State control the best kind of a forestry reserve. There were a few pines, but most of them have been removed. There is a wide range of herbaceous plants, for the character of the soil varies widely. It is a charming wild tract. There are a few settlers, but they would be glad to leave, if paid a nominal price for their claims. The land is mostly in the hands of large owners, who hold it cheap. Mr. D. A. Blodgett says his firm is selling for seventy-five cents per acre, but they would prefer to donate it to the State for a reserve rather than sell it at this rate.

The advantage of such a reserve to science is no small item. There the native flora and fauna would be preserved for future study.

The United States government has reserved the Yellowstone Park for these same purposes, and if we ever wish to do this, the present is the only time.

In 1883 or 1884, Wisconsin reserved twenty-one townships. It was railed at as being a scheme to further the purposes of a few speculators. But the reserve being at the head waters of some of her main rivers, it is not difficult now to estimate somewhat the immense value it is becoming to the State.

Such a reservation would give us data as to facts of tree culture and forest influence that we could not otherwise get. It would enable the State to test these questions on a scale of such magnitude as to be of great value.

Prof. Bailey: Does the Au Sable rise in those six townships?

Mr. Garfield: They occupy the divide or watershed of it and the Muskegon.

Mr. Hollister: Would you limit the reserve to six townships?

Mr. Garfield: Not if we could get more.

The following resolutions of the Michigan Sportsmen's Association were presented by Pres. E. S. Holmes:

Resolved, That it is the sense of the Michigan Sportsmen's Association that a State Park would prove a great public benefit in the protection of game, our forests and the sources of our streams;

And that we desire to urge the State Forestry Commission to take active measures in that direction.

Resolved, That the President be requested to present the foregoing resolution to the Forestry Commission and urge the favorable consideration thereof.

All which I certify, Jan. 27, 1888. MARK NORRIS, *Sec'y.*

The above resolutions were adopted at a meeting of the Michigan Sportsmen's Association held in Detroit January 25, 1888.

Dr. Holmes gave as the reasons for the association's action: That a State Park would prove a great public benefit in the protection of game, forests and water courses.

Seth Green has said that an acre of water may be made to produce more food than an acre of land. If so, how important to preserve our springs,

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lakes and rivers. The Almighty does not forget us. He still pours his rains on the just and the unjust, and it is our duty to conserve these rains and turn them to the best account.

Mr. Garfield: Will Dr. Holmes give a fuller account of the association's reasons.

Dr. Holmes: We desire it as a protection to fin, fur and feather; as a sanitary influence for the whole State; as a preserver of the Manistee, Muskegon and Au Sable. As a preserve to game it would serve as a breeding and development grounds for animals and fishes to go out in to the rest of the State.

Mr. Hannah: As a boy, rafting down the St. Clair, I used to enjoy anchoring on the "flats" where there were millions of ducks. Many a time I have gathered a bushel of eggs in an hour or two. To-day there is not a duck where there were thousands then. Now, if we had such a preserve, would all the game go there and stay? If we can realize sufficient advantages from such a park it can be had. The question is how is this to prove advantageous to the State? How is it to be a paying investment?

Mr. Garfield: A leading lumberman told me a short time ago that if we could have a tract of land protected from fire, thieves and hunters it would soon teach us just what you are asking for.

Mr. Hannah: There are hundreds of acres of light sandy land, from which all timber has been cut or burned, and on which there is nothing but bunch grass. I would like to see those acres put to some use. I move the adoption of the resolutions submitted by the Sportsmen's Association.

The resolutions were adopted.

Report of the Committee on Exhibit by the Chairman, H. D. C. Van Asmus, was presented and adopted.

PROPER BASIS OF FORESTRY LEGISLATION.

[BY HON. B. E. FERNOW, WASHINGTON, DISTRICT OF COLUMBIA.]

GENTLEMEN: When your directors invited me to ventilate my views, I thought it was asking me to bring coals to Newcastle, but I am glad on my own account to have this opportunity of meeting you at this convention. We usually go to such places to show our knowledge or hide our ignorance, but I fear I am not very well acquainted with the special conditions which affect the question of suitable legislation for your State. In seeking data, I came across many blanks in my sources of information, as you will see by the table prepared, where eleven thousand acres of Michigan's territory have to be set down with an interrogation point.

Ignorant legislation is criminal legislation. If this is true, it behooves legislators to acquire the needed knowledge of the conditions of the object of their legislative action. Ignorance has had a large share in the useless haste with which the virgin forests have been and are still wastefully disposed of, and ignorance also clouds the future of our forestry interests. Ignorance as to the technical value of different timbers has done as much harm as any other cause in wasting our forest resources. Had it been known, for instance, that hemlock for some purposes was as good, if not better, than pine, not only could the forest have been utilized to better advantage, by allowing us more material from the same place at the same time, but also the young growth would have a better future. Ignorance as to the supply of white pine, stand-

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ing, or rather doubtful information and delusion, have brought us very suddenly and more rapidly to the end of these supplies than we would have arrived had we taken care to keep watch of the same. And so in all directions I could show you that ignorance—of individuals and of the community—has been harmful to our forestry interests. To dispel this ignorance should be the first step of your legislation. A thorough and reliable canvass of your forest resources and their condition and location is needed before you can wisely legislate upon them. A periodical canvass of the lumber business and the various wood-working establishments, with a view of keeping an approximate idea of supply and demand before the public seems highly desirable, and other statistics which will aid in a proper appreciation and consequent rational legislation, with regard to forestry interests will suggest themselves.

Before State interference, by way of legislation, should be called for, the following questions, it seems to me, should be answered: Is not private interest strong enough without special legislation to regulate the difficulty which seems to have arisen? Are simply private interests involved, or have the whole people or whole communities a direct interest in the settlement of the difficulty? Are not communities strong enough to regulate the matter, or must the stronger and the more efficient, more lasting power of the majority of the people of the State, be called upon to legislate? Is the object for which legislation is called for of more than usual interest to the Nation or State, and does neglect in dealing with it entail losses, material or moral, direct or indirect, present or future to the State? Whoever proposes legislation must be able to show that, and why, in any given direction it is needed, and he must also be conscious of the position which government ought to take towards the interests in regard to which he proposes legislation, and he must also understand how far State organization is capable of carrying out the law; how far it can be left to the private interest to be carried out. You have heard of the influences which the forest exerts on climate, water-flow and agricultural conditions in general. In this respect, at least, if in no other, the forests are distinguished broadly from any other form of natural wealth; and in this respect even the advocate of individual self-direction will not expect reliance to be placed on private citizens to so use their forest property as to serve this special function of it, in which his neighbors may have more interest than the owner himself. Indeed the history of all countries, not alone that of our own, has shown that private interests cannot be so relied upon; that forest destruction and devastation is the only consequence of such reliance; that private and financial interests alone can be expected to control the action of private owners.

That special legislation, then, which is the strong expression of the interests of the community, is needed for forests and forest property, can admit of no doubt. The forest legislation which is needed in Michigan as well as most other States, must be directed, first, to a better protection of the forest property, as long as it may last, which we have from nature's kind hands; secondly, protection of the future crop, as far as nature has kindly restored it or man has planted it; thirdly, it is to provide and make accessible such information as will enable the people to utilize their forest growth to better advantage, will enable them to see the necessity for reforestation in certain places, and the desirability in others, furnish the basis of a rational system of forest management, just such as we attempt to introduce into agriculture; fourthly, legislation may go so far as to recognize a temporary need of

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directly encouraging a private activity in planting and caring for forest property by means of temporary financial assistance or other aids, reduction of taxes, etc. Forestry in Michigan I consider mainly from the standpoint of the lumberman, as the basis of lumber supply. If the lumber industry and its dependencies can be persuaded to see their interest in forestry we may soon expect a change in the methods in which our natural supplies are exhausted and in the absence of methods in securing future supply. It might be argued that industries are apt to take care of themselves under the influence of the law of supply and demand and that private interests will be sufficient to guard against any but temporary injuries. While this may be quite true with regard to industries, the material of which is capable of yearly production and ready adjustments of supply and demand—especially when a knowledge of over or under production is easily obtained—the forestry industry is not to be compared with any of these. Its essential differences are, that the crop takes from twenty-five to one hundred and fifty years to become useful; that such long waiting for results is not a feature inviting private investment; that during the long time of probation accumulative risks to the investment are threatening; that the possibility of utilizing the crop sooner or later will always tend to induce realization as early as possible and therefore keep the supply of heavier material short. Lastly, a knowledge of the conditions of supply—or crop area if you please—is more difficult, almost impossible, indeed, to obtain by private effort, although the demand may be to a more definite extent determined. In short, the scale which balances the supply and demand of forest products adjusts itself so sluggishly that application of this economic law of adjustment may be very beautiful in theory, but must in practice appear of problematical effect, and therefore there exists a strong incentive for the community to supply additional weights which will hasten the adjustment of the balance.

Among the first acts, then, after protection of property is provided for, I would call for the appointment of an energetic Forest Commissioner well fitted for the position, well paid and suitably provided, charged with the forestry interests of the State in all their bearings, who would procure and digest for you the statistics, who should interest himself in seeing fire and forestry laws executed, who should furnish such information as is needed by forest planters, legislators, manufacturers, etc. You might delegate such duties to an unpaid commission; that is cheap and correspondingly useless; you might impose these duties upon your Board of Agriculture, and with such an efficient secretary and excellent personnel of the Board as you have, I have no doubt they would do their best. But the best horse put to an overload will pull himself to death or become a balker. That the gathering of such statistics as I have advocated, and the other duties outlined, must be entrusted to a man specially fitted and specially charged with such work, is evident, if you wish to accomplish anything of note. If you want to legislate for forestry don't begin with half measures, and instead of launching out in half a dozen directions have one thing done well. An efficient Forest Commissioner, well paid for his services, well provided with the necessary funds to do his work—good work costs—will repay soon the expenditure to the State, by an awakened interest in forestry matters on the part of the community, by an appreciation of the importance and the position of forestry towards all other industries, by affording a proper basis for intelligent legislation, and by dispelling the ignorance which keeps our people from giving

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more attention to this great interest. If you have more money to spare for this interest, there are many ways in which it can be properly and effectively applied and which I have outlined further on.

Michigan, as far as I know, has no fire laws which protect her forest property. If she has, they are certainly not effective, as you are all well aware. If in one year, like the last, property to the extent of $10,000,000 or $12,000,000 was destroyed by forest fires, would it not pay to spend the interest on that sum in protecting the capital? Legislation on this point is so important that it should form a full and comprehensive chapter of its own and not be mixed up with anything else of forestry legislation. It is simply the moral obligation of the State to do its duty in protecting my property efficiently, which I call upon, forestry or no forestry. But this cannot be done simply by enacting a law providing all sorts of things and threatening all sorts of punishment. Providing the machinery for the enforcement of the law is of more importance than the enactment of the law. In fact, the forbidding by law, which is so easy, will never meet the case; it is the organization of communal and private interests in carrying out the law which we must look after. If the community is made aware that it costs them something to have a fire put out, if everybody can be forced to help extinguish the fire or be fined, and is held strictly accountable for acts by which injury comes to another, he will be more careful for himself and will also help to guard against others, especially when in addition a designated fire warden is charged with this interest of the community, and a higher authority with looking after the due enforcement of the law.

Prevention of fires is of course better than fighting fires, and any regulations that will reduce the chance of danger from fires should be first considered. These can generally be only indirect. But one direct and legitimate manner of preventing fires from one cause is in our hands: we can enforce the use of spark-arresters in locomotives by railroad companies. Such appliances are used with entire satisfaction on most locomotives of the Pennsylvania Railroad Company and elsewhere. An additional order, to keep rights of way free from inflammable material, which is easily accomplished, and fixing the liability of damage on the part of the companies, disposes of one class of fires, and not a small one, easily.

There still remains to be considered the legislation of direct encouragement to tree planting. This, in my opinion, is the last to be attempted, the most difficult to devise and execute, the most harmful to the morals of a community if not properly framed and guarded. If there is not proper authority provided to watch over the compliance with conditions upon which the community extends its helping hand, I should say, don't touch it. Yet with a Forest Commissioner to look out for the interests of the people such direct encouragement is not impossible. I said to the Pennsylvania Board of Agriculture the other day; "The provision of your recent law, which will allow me a release of taxes for three decades of 45, 40 and 25 cents per acre at the highest, does not even encourage me to undergo the trouble of asking for it, although I have some 4,000 acres which I could bring under the provisions of that law." A distribution of plant material, free or at nominal charges, in sufficient quantities to those who wish to plant their waste places to trees, it seems to me, would be more encouragement, less trouble and answer a better purpose.

To give you an idea of what I mean by sufficient quantities, I will state

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that poverty-stricken Prussia—which I believe is about double the size of Michigan—with an excellent forest administration and a people fully alive to the importance of forestry, distributed last year, free of charge, over 38,000,000 seedlings and 24,000 pounds of seed at nominal prices. The United States government encourages forest planting by the distribution of seeds and seedlings to the value of about $500 a year.

In some localities, as on the sandy shores of your State, the preservation of the forest cover is of such importance to the community at large, that it may be wise for the State to own such tracts and maintain the same as forest reserves. A State law which will encourage the holding of forest areas by townships or counties, and their administration under the direction of the Forestry Commission or Commissioners, is highly desirable. There is no reason why a township or county should not own and manage a forest, when it is in the interest of the community to so own forest property, just as they own and build roads, bridges and school-houses, or as a city owns its municipal buildings and other property. The community is not only richer than the private man but is longer-lived, and can more conveniently wait for returns. Let, then, where public interest should demand afforestation, the community step in and plant the forest, charging the outlay in the form of a lien or mortgage upon the growing forest, with all the rights and liabilities that usually pertain to such investments, except that the interest may accumulate until the crop is ripe and ready to be marketed, when the loan, with accumulated interest, must first be repaid before the owner reaps any benefit. Any such forest planting, now begun, will at the time when the crop becomes useful prove such a satisfactory investment that no further encouragement for careful forest management will be required by the harvester.

During the delivery of the above address Mr. Fernow produced figures showing that the value of tree products during the past years was $870,000,000 direct from our saw-mills, and showing that in 1884 capital in manufactures using wood alone was $83,926,663; the number of employés, 74,869; wages, $28,012,950; ratio to other manufacturers 46 per cent. in number, 61 per cent. in capital, 60 per cent. in employés and 61 per cent. in wages; also the number of cords of wood from farm forests was 5,822,472; value, $8,898,528; product of saw-mills, $67,000,000.

It was said that a citizen of Wurtemburg could not cut down a tree without permission, even on his own land, and for every acre cut an acre must be set.

The German government owns but thirty-five per cent. of the forest area, fifteen per cent. is communal and fifty per cent. is under private ownership, over which the government has *no* control, except in cases where it is shown that the removal of such private forest would do injury to the public, as in the case of shifting sands. A question of this kind is referred to a commission of three, who decide whether the forest is protective or not.

Pres. Willits: Are any arable lands, in Germany, used for forest culture?

Mr. Fernow: As far as may be the land unfit for agriculture is given to the cultivation of forests and an equal area of better land is taken from the forests and turned over to agriculture, so that now comparatively little land good for agricultural purposes is reserved for forests.

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Pres. Willits: That brings up a difficulty. We have not in this State large areas of valueless land for such purposes. I don't know how this forestry reservation can be made, except by the State. Farmers tell us they can get fuel cheaper by growing wheat and selling it to buy coal than by raising wood. The need of wood for fuel, fences and buildings is steadily lessening. We are going to get along with less and less lumber every year.

I was disappointed in San Francisco, by finding the buildings constructed almost entirely of wood. I did not understand it, till I was told it was because of earthquakes.

But the great forestry question is climatic influence, influence on rainfall and streams. Certainly one of the plainest duties for us to attend to is the fire protection.

Mr. Fernow: In civilized life there are all the time new demands arising for the use of Nature's gifts, and though it may be within the bounds of possibility to find a substitute, if dire necessity compels us to it, yet that necessity is not a thing to be even lightly courted. I certainly agree that when land is fit for agriculture it should be so used, but there is certainly a large amount of waste land in this State on which experiments in forestry might be profitably conducted.

BIG RAPIDS, MICH., *Jan. 23, 1888.*

PROF. BEAL, *Dear Sir:* Your invitation to join in the discussion at the Forestry convention, coupled with the request that, if I can not be present, to furnish a paper on "Economy in the Use of Timber," is received.

We fear that any discussion of this subject will be of little use, it comes too late to remedy any past mistakes, if such have been made, and at the present time the owners of timber and the manufacturers of lumber are fully convinced that it is for their interests to destroy nothing that can be disposed of at a slight advance upon the cost.

The day is past when black walnut will be cut, logged and burned simply to get it out of the way, and when all pine trees less than a foot in diameter will be left for the forest fires to consume; the owners of such timbers to-day know their value and are careful to demand their full worth.

It is not strange that we should cry "Halt!" when we know that even in our own State there are daily consigned to the burning pit thousands of cords of refuse timber, and that many acres of land each year are cleared of their superfluous wood by burning. Knowing this, and also that in all our large cities are multitudes of people who suffer for the want of fuel, it is natural for us to look upon the destruction of the same as needless, and upon those who thus dispose of their own property as unnecessarily wasteful. If there is waste here, let some better method for its disposal be devised and brought to the attention of the owners, and they will be found ready to adopt any plan whatever that can be shown to be profitable.

We venture the assertion that if there is any lack of economy in the use of our native timbers to-day, it is the result of ignorance of how better to manufacture and dispose of the same rather than from any other cause. No one wantonly commits to to the flames anything that he can change into money at a profit.

In this city of Big Rapids there is manufactured a large quantity of frames for woven wire beds, cut from dry, hard maple plank, and each day wagon

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loads of pieces, sound and perfect, are drawn from the factory and burned. How these can be made profitable in manufactured articles has been the question under considération for months, but still unsolved, and so the fire burns on.

When the scarcity of timber caused an increase in the price of shingles so as to make it profitable to rescue the old and decaying logs from the fires and to saw off pine stumps and make them into shingles, mills were built by the dozen, and so when the price of mill culls will warrant it the branchless dead pine trees, the monuments of forest fires, covering thousands of acres, will be turned into lumber.

We often hear of the wholesale destruction of the pineries and loud complaints that this should be allowed to continue unchecked, but why not? Is it not an admitted fact that a very large part of the pine in our western States has reached maturity and is rapidly deteriorating in quality on account of its age, and if so, is it not true economy that it be cut as fast as there is market for it? Make the demand less and the supply will diminish; if it is better to save than to cut it, convince the farmer that he can build wire fences and brick houses cheaper than wooden and he will buy less lumber. "But," says one, "at the present rate of cutting away our forests it will be but a few years before our timber will be all gone, and what will people do then to supply their wants?" If we should answer that this will be their affair, not ours, we would no doubt be called selfish, having no interest in the future welfare of our race and deserving the condemnation of every true philanthropist. Still we confess that it is about as difficult for us to feel any anxiety lest our remote descendants shall not be properly housed and warmed as it was for Mark Twain to weep over the grave of Adam. When necessity compels, men will be found equal to the emergency; when the raising of forest trees becomes profitable on account of the scarcity of lumber, the descendants of the lumber barons of our day will be found side by side with the fruit growers, planting their orchards of forest trees.

We hear no one advising that we use less of coal, iron, natural gas, or petroleum lest the supply be exhausted, neither would I advise the keeping of our forests for unborn generations of men, if we need them to keep ourselves warm or to make our homes more attractive and comfortable.

In conclusion, it seems to me to be true economy to cut all that is necessary to supply the demand, to make that demand as great as possible by inventing methods of using at a profit much of that which is now burned as refuse, and—shall I dare to say?—to cut off and burn it when it cannot be profitably marketed, if the soil is needed for farming purposes.

A. J. DANIELS.

SOME MEANS FOR ENCOURAGING AND STIMULATING FOREST PLANTING.

[BY UNO H. HILLMAN, FORESTDALE, BARNSTABLE COUNTY, MASS.]

Forest planting is all right in its place, but it is expensive and tedious. In order to induce men that only have a period of form thirty to forty years to look ahead to, as most farmers will average after having taken possession of a farm, the laws for the protection and preservation of our forests must be such as to give the owner of a forest a thorough guarantee that his forest property is being protected with the same scrupulousness as the rest of his

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property. The remittance of taxation will never accomplish much, because it creates an ill feeling and must cause discontent, because a relief in that direction is not real, but only apparent. A certain sum must be raised by taxes each year. If I pay taxes on 50,000 acres I pay a less percentage per acre, but if I, or any community, shall be exempt from taxation on 45,000 acres of woodland and pay all the tax necessary for the annual expenses from 5,000 acres under plow, I certainly pay the same amount, only differently proportioned.

I think that the best and most effective stimulant for the increased and healthful interest in our forest properties lies in each State appointing a good, through forester, whose duty it shall be to deliver popular lectures upon Forestry in the different granges or communities; assist the farmers and forest owners to acquire necessary knowledge as to the different methods of planting; show what kinds to plant; superintend the keeping of game laws as far as practicable; travel around where requested to do so at no other expense to the farmer than his board while with him—the State paying everything else.

This, I believe, would in a short time show most gratifying results.

FOREST FIRES—DAMAGES DONE—THE CAUSES AND REMEDIES.

[BY UNO H. HILLMAN, FORESTDALE, BARNSTABLE CO., MASS.]

In valuing the damages of a forest fire, it has been and still remains the custom, in this part of the country, to calculate the loss of wood per cord or cubic foot, and then offer a certain percentage of this loss in settlement, when a settlement is at all obtainable. Now this method seems to me the most unjust and least equitable that could possibly be thought of. The value of the wood exposed to and attacked by a forest fire is certainly very great, and so in proportion to the growth of the wood, as far as thickness, age, quality, etc., are concerned, but I firmly hold that the real and greatest damage to the nation is done by the burning of the humus that has collected under the trees in every forest. In proof of this statement I cannot, at least this time, go into lengthy details, but simply point out a few facts which will be all-sufficient to persons of your attainments.

The humus represents decayed and decaying vegetable matter, together with the remains and droppings of countless insects, other animals and fungi. Decaying vegetable matter exposed to the air creates an effective, and perhaps the most effective, nitre-bed. Humus exposed to the influence of air undergoes a slow combustion, thus continually creating carbonic acid in the soil. This carbonic acid is the most potent solvent of all plant-food elements and converts the absolutely inert ones into easily assimilable plant-food. The active humus, i. e., a humus continuously furnished with vegetable matter for decay, is the undeniable medium through which a farmer can supply his growing crops with the necessary nitrogen from the atmosphere, instead of purchasing it in questionable quantities from fertilizer manufacturers at eighteen cents a pound. The active humus will also enable the farmer to advantageously use phosphorus and potash containing materials in a crude and otherwise inert form, instead of procuring these indispensable plant-foods in a readily soluble form at a ruinous price. If we shall see the day when our farms have lifted their mortgages and the owners are happy and independent, we must hasten on the day when the farmer shall consider it his first and

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principal duty to furnish his fields with an never failing supply of active humus. A wood-lot of but comparatively few acres, will accomplish this annually; the plowing under of green crops will materially aid.

In the adjustment of the damage caused by a forest fire, I think real damage is best and most equitable represented by the tax valuation multiplied by number of years required for forest to mature from seed. For instance, a wood-lot is destroyed by fire; the trees become more or less valueless and the loam, with its supply of tree-seed, is burned. The valuation upon which an annual tax was paid for this wood-lot was, say, two dollars per acre. The kind of trees grown required fifty years to mature or become marketable. Then the fire damage to this lot is 50x2 or $100.00 per acre. Consider the fact that no seed will germinate and grow in the loose ashes of the burned loam unless they become mixed with the ground below; the necessity of replanting, as the seed is destroyed; the loss of loam; the fact that municipal taxes must be paid annually, whether there is any prospect of income or not, and I think you will find this amount small enough. Each community requires so much money each year to defray its necessary expenses; if a wood-lot, that has been paying a certain sum annually, either ceases to contribute or does so with a smaller amount, the remainder of the property in that community must make it up by paying just so much larger taxes. In purchasing or holding a wood-lot, we pay or attribute a certain value to it, based upon the fact of a crop after so many years. But we must pay taxes every year.

As to the remedies, the question is difficult of solution, but I believe all damages caused by forest fires should be made recoverable through the State, i. e., prosecuted by the attorney general, free of cost, to the owners of the destroyed property. The reasons for this are many and important, as you can see without my occupying your valuable time by enumerating them. All legislation in reference to forest fires cannot be too severe.

We have here a case in point just now, the outlines of which may be interesting to you, therefore I shall give them in brief.

On the 11th of May last the Old Colony Railroad and Steamboat Company of Boston ran a *freight* train as usual from Boston to Provincetown. When this train reached a certain point in the town of Baurne, called "Jonathan Baurne's crossing," the train hands saw sparks emitting from the tender and igniting the adjoining bush, and could, according to their own statement, have put out the fire in a few minutes, but they did not consider this necessary or "worth their while," so "left the fire to the section hands to take care of" and continued. The consequence was that some 60,000 acres were totally destroyed, and, the ground being very dry, most of it was burnt down to hard-pan. Now I understand that this corporation is willing to settle the damages on a basis of about *eighty five cents per acre.* Just think of it! What is it that can possibly induce this corporation to offer so utterly humiliating and totally inadequate terms of settlement? Simply the knowledge of what an advantage a rich and powerful corporation possesses over an individual, and this a *farmer* at that, in our system of legal procedure.

Personally I lost by this fire some 2,200 acres of land, about 1,841 of which was wooded and certainly contained over 10,000 cords, the remainder was a good, natural pasture, now totally destroyed. Then I lost about 26 miles of barb-wire fencing and cedar posts.

The 18th inst. this corporation sent one of their attorneys to see me and ask if I would not accept compensation upon the following basis:

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1,841 acres woodland	$1,556 00
Damage to pasture	75 00
Damage to fence	119 00
Total	$1,750 00

Well, what do you think of this? Is it not curious and characteristic enough to be handed over to our National library in Washington and preserved as a memento of the sway and power usurped by monopolies and money in this country?

It is needless for me to say that I did not accept this generous offer.

It is but fair to state that wood here is not generally grown for manufacturing purposes, but finds a ready market as fuel at five dollars a cord.

As you doubtless will have many men of great eminence among you at the conference, the different parts of your exhaustive program will be so thoroughly and skillfully discussed that any further remarks from me would simply appear ridiculous, and, while I am afraid that the above already might be so classified, I take consolation in the fact that these few thoughts of a backwoods farmer will reach you before you have had a chance of basking in the light of so many luminaries.

If you should see fit to favor me with a copy of the full proceedings and discussions at this convention, I shall consider myself under great obligation.

Very much envying you for the opportunity of being present at this illustrious and important assembly, I remain, my dear sir, yours very sincerely.

The committee on resolutions reported no cause for action.

Mr. Garfield moved to tender a hearty vote of thanks to the Grand Rapids Board of Trade, who have so kindly provided this hall for our use and have taken so much interest in our meetings. It was adopted unanimously.

Mr. Garfield moved a vote of thanks to Mr. Fernow for coming from Washington to assist in our deliberations.

After the adoption of this the chairman closed the convention with a few congratulatory remarks on its success and the widespread interest it had evoked.

NO. 33.—HINTS FOR ARBOR DAY.

In the preparation of this bulletin much assistance has been received from Prof. F. M. Kendall, superintendent of schools, Grand Rapids, and some of his associates, Misses Josephine Ahnefeldt, Helen L. Dickey, Madeline Kennedy, Flora Cromwell. My assistant, E. R. Lake, and Hon. B. G. Northrop, of Connecticut, have prepared certain parts of the manuscript.

W. J. BEAL,
Prof. Botany and Forestry.

AGRICULTURAL COLLEGE, MICH., March 1, 1888.

It is eminently fitting that the "treeless" State of Nebraska should have the honor of originating the pleasant custom of Arbor Day. At the instance of the State Horticultural Society, about the year 1874, a day in the spring

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was set aside for tree planting. The feature met with such general support that the State Legislature, at its next session, took action favoring the annual observance of such a day.

Over twelve thousand trees were planted in that State on its first Arbor Day. This happy beginning enlisted such general and widespread favor that other States soon followed with similar action.

The peculiar fitness of the custom soon led to its adoption as a holiday feature of our public schools. In the state of Connecticut, where the movement has been under the direction of Prof. B. G. Northrop, the school children have greatly beautified and enriched the State by the observance of Arbor Day. The school grounds all over the State have been changed from plain, cheerless, uninviting *yards* to attractive shady parks and groves. The roadsides, likewise, by application of the same deft hands and eager minds, have been lined with stately elms, graceful maples and beautiful shrubbery.

Our own State has done something in this direction and especially so last year. The Arbor Day exercises at the State Agricultural College last spring were such as enlisted the hearty coöperation of the students and proved a most enjoyable affair, long to be remembered by those in attendance and, especially, those participating.

The exercises were opened with prayer and music. President Willits read the Governor's Arbor Day proclamation and made a short speech. Brief and appropriate speeches were then made by Profs. Kedzie, Beal and Bailey. This part of the program was pleasingly varied by music, songs, poems, declamations and recitations by the students. Each person speaking treated the subject from his standpoint, thus varying the remarks to such an extent that no chance of repetition was afforded.

President Willits spoke of the economic uses of trees to a country; the various influences forest areas have on a people; the history of forestry in older countries, and how deforestation has affected the politics of some European nations.

Dr. Kedzie dealt with the climatic effect of forests; their influence on rainfall, temperature, winds and malarias, and their effect on soil and air drainage.

Dr. Beal talked of their botanical features; their family relationships; their effect on the flora of a country or State; their useful and ornamental properties and their value for botanical study.

Prof. Bailey told what characteristics attracted the horticulturist. He called attention to their use as windbreaks and nut bearers; their use in ornamenting parks, grounds and streets; their expressions as individual trees and collections; their beauty of form and foliage when properly planted, trimmed and grouped, and the great source of pleasure and study they are to one having a taste for nature's works.

Governor Luce and Senator C. J. Monroe also made short and pleasant speeches endorsing Arbor Day and expressing their sympathy with the movement. Both agreed that its influence on the education and morals of the youth was inestimable; that it would soon become a universal custom; that it is a very appropriate factor in education, and that it ought to meet the entire approval and support of every school and college in the State.

After the above exercises, occupying about an hour, all adjourned to a part of the grounds where the senior class had decided to plant a tree. Here the

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class president made a short speech, dedicating the tree to the class and consigning it to the care of the college with well wishes for its future growth and prosperity. President Willits responded by accepting with gratitude and thanks; cautioning all present to do the tree no harm and invoking their aid in its behalf. The tree was then planted by placing among its roots, as they were outspread in the hole where it was to stand, a bottle containing a list of the names of the class and various class mementos, after which each member threw in a shovelful of earth and helped "tramp it down." This done they passed to the "junior tree" and so on with the four college classes, two fraternities, three literary societies, the "Co. Eds.," base ball team and "Mechanics," till all had shared an equal part in Arbor Day. The exercises were so aptly varied that interest was easily kept up to the end.

One other occasion is also prominent in the history of this movement in our State, namely, the Arbor Day exercises given by the pupils of the Grand Rapids schools on the evening of January 26, 1888, in connection with the Forestry Convention of that city. Though no trees were planted, the presentation of a literary program designed to be suitable for adoption by the schools of the State was very creditable.

The exercises assumed the nature of a convention of trees. The meeting was called to order by Norway Pine, who moved the election of a chairman and secretary. After the election followed general speechmaking, interspersed with music and songs. Each tree set forth in a few brief sentences his characteristics, properties, uses and various values. The exercises lasted nearly an hour, enlisting much applause, and all agreed with one accord at the finish that they were only "too short."

ARBOR DAY IN SCHOOLS.

[BY PROF. B. G. NORTHROP, OF CONNECTICUT.]

The act of the last Legislature in Michigan, constituting the State Board of Agriculture an Independent Forestry Commission, is a good example for other States. By the action of the Legislature in March, 1881, Michigan became the third State in the Union, which, up to that time sanctioned by law, the observance of Arbor Day. At first, economic tree-planting was the primary aim of Arbor Day, and the coöperation of youth was not then specially invited. I am glad to learn that the new Forestry Commission of Michigan at the outset encourage Arbor Day in schools. This proposed convention at Grand Rapids, with its practical scheme of topics, promises so much for Michigan and for the country, that I regret my inability to be present, sharing in your discussions and witnessing the Arbor Day exercises of the pupils on Thursday evening. To aid in the general adoption of that "suitable program" by the schools of Michigan I send, as requested, a brief paper.

Arbor Day in schools is now widely approved. But six years ago, when the American Forestry Congress appointed a committee to urge its general adoption, the project was pronounced unwise by high authority. The logic of events, however, has answered all objections. The plan has stood the crucial test of experience. Already Arbor Day in schools is observed in twenty-six States. Tho governors in seven other States and territories have promised to "urge such action upon the next legislature."

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To interest youth, is now made a prominent aim of Arbor Day wherever such day is observed. The economic and esthetic here go hand in hand. This enlisting of schools has proved a most effective way of calling public attention to the importance of forestry. Parents and the public like to share the work, when they see how children are learning to plant and to protect trees. Their utility and beauty are impressively set forth in Arbor Day proclamations and in circular letters of state, county, or city school superintendents, in the local press and in school celebrations, with appropriate essays by scholars, declamations and songs, and also brief addresses by prominent citizens. A district, town, city or county is easily led to patronize such a work in which youth are the actors. With proper pre-arrangement in awakening popular interest and in the selection and procuring of trees, vines and shrubs, Arbor Day may accomplish great things, and many hands make merry as well as light work.

This work naturally extends from the school to the home, leading children to share in door-yard adornments, and in planting trees by the wayside. With the efficient aid and encouragement of the new State Forestry Commission and the stimulus of this State convention at Grand Rapids, more trees should be set out by the roadsides of Michigan, on next Arbor Day than in any previous year. Much as has already been done, nothing can add so much to the beauty of the roads of Michigan as long avenues of fine trees. One sees this happily illustrated for hundreds of miles on a stretch in some European countries. Growing on land otherwise unused, such trees yield most satisfactory returns. The shade and beauty are grateful to every traveler and doubly so to the planter, as many of the farmers of Michigan can testify. For there is a peculiar pleasure in the parentage of trees, whether forest, fruit or ornamental, and a pleasure that never cloys, but grows with their growth. Like grateful children, trees bring rich filial returns and pay a thousandfold for all the care they cost. Then, on next Arbor Day, let every citizen of Michigan—certainly every parent and every pupil—girl or boy, plant or help in planting (if a child is too young to work alone), some flower, shrub, vine, or tree, to be know by his or her name. Such offspring they will watch with pride, as every month or year, new beauties appear.

A CONVENTION OF MICHIGAN TREES.

Norway Pine (Louie): Fellow trees of Michigan, to organize this meeting I move the election of White Oak as chairman. (Seconded.) All who favor this motion please say aye. (Unanimous vote.) Those who are opposed will say no. The ayes have it, and White Oak will take the chair.

White Oak (Julius): Fellow trees, the object of our meeting is to consider whatever may be to our best interests in the forests of Michigan. It is a subject of great importance to the State and to all of us, and we hope to gain much valuable information from each other and to hear from every one present.

We have gathered from all parts of the State for this conference. As we should keep a permanent record of our proceedings, and as the newspapers will probably wish to publish our papers and discussions, I think a secretary will be needed to take the minutes of this meeting.

Beech (Harry): I nominate Chestnut (Lillie) to act as secretary. (Seconded.)

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White Oak: All who favor the nomination last made will say aye. Those who are opposed will say no. The ayes have it, and Chestnut is elected secretary. (She takes her place.)

White Oak: Our musician, Pine (Bessie), has kindly arranged the music for us. She sings only when the spirits move her. We may know when that is by the peculiar swaying of her head. At the swaying let us suspend business and listen. She moves—we will hear "The echoes from the Forest."

White Oak: We are now ready for discussion. (Several trees rising at once.)

White Oak: Tulip tree has the floor.

Tulip Tree (Herman): Fellow trees, I am glad to have this opportunity to plead my qualifications as an ornamental tree. I grow to a great size and height and have shining, queer shaped leaves and large, tulip-shaped blossoms which remind you of the sunny South, where my sisters, the Magnolias, live.

Burr Oak (Joseph): I should like to ask Tulip tree of what use he is? Michigan people have a right to demand of us both usefulness and beauty.

Tulip Tree: I am not only valuable as an ornamental shade tree, but I also furnish excellent timber for carriage bodies, furniture, and finishing houses. Years ago my forefathers were numerous south of the Grand River Valley, and supplied wood for laths, shingles, and lumber in the place of the white pine. Our family is a small one, represented in Michigan by a single species.

White Oak: We shall be glad to hear from any members of the Oak family who live in Michigan. (Sixteen members rise.)

White Oak: This is certainly a large family. I recognize Chestnut as entitled to the floor. What claims have you to rank in the Oak family?

Chestnut: All botanists of the present day agree that the Beech, the Ironwood, the blue Beech, and the Hazels and Chestnuts are first cousins to the Oaks. I live in four counties in the southeast part of the State and am well known for valuable timber and a good crop of edible nuts.

Beech: Upon my smooth, gray bark many a heart history has been carved. The poet Campbell tells it so beautifully:

> "Thrice twenty summers have I stood,
> Since youthful lovers in my shade
> Their vows of truth and rapture paid,
> And, on my trunk's surviving frame,
> Carved many a long forgotten name."

And here is another beautiful thing from Whittier:

"I have always admired the taste of the Indians around Sebago Lake, who, when their chief died, dug round the beech tree, swaying it down, and placed his body in the rent, and then let the noble tree fall back into its original place, a green and beautiful monument for a son of the forest."

I am one of the commonest and best known trees of Michigan.

Burr Oak: Ten of us Oaks, out of about 300, live in this State. Brother White Oak is by far the most common and well known. He is the senior member of our family and has attained a very great age. He never thrives in perfection except in a good soil and in a temperate climate. The Michigan people are proud that so many of our family live with them.

Tulip Tree: White Oak is certainly loyal to his family, but I should like to hear the uses of this tree.

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Burr Oak: Every particle of him is useful, even to his ashes. His bark is used for tanning leather; his wood is hard, compact, heavy, tough and durable, good for heavy wagons, plows, railroad ties, fence posts, ship timber, furniture, and finishing the interior of houses.

Swamp White Oak (Leona): As much of my timber is so nearly like that of White Oak, and often passes for it, I will say as a tree, "I am beautiful in every stage of my growth; at first, light, slender, delicate and waving; at last, broad, massive, and grand, but always graceful."

Chestnut Oak (James): Emerson says of White Oak: "As an ornament to the landscape, or as a single object, no other tree is to be compared with it, in every period of its growth, for picturesqueness, majesty, and inexhaustible variety of beauty. When standing alone it throws out its mighty arms with an air of force and grandeur which have made it everywhere to be considered the fittest emblem of strength and power of resistance. Commonly the oak braves the storm to the last, without yielding, better than any other tree. The limbs go out at a great angle and stretch horizontally to a vast distance."

Laurel Oak (John): The famous A. J. Downing said: "There are no grander or more superb trees than our American oaks. We are fully disposed to concede it the first rank among the denizens of the forest. As an ornamental object we consider the oak the most varied in expression, the most beautiful, grand, majestic and picturesque of all deciduous trees."

Black Jack Oak (Herbert): Poetry, history, mythology and romance abound in references to the oak. I should like to hear from our fellow trees some common quotatious in reference to the oak.

White Ash (Myrtie): "The unwedgeable and gnarled oak."

Black Ash (Ella): "The old oaken bucket."

Sugar Maple (Louise): "Jove's own tree that holds the woods in awful sovereignty."

Red Maple (Anna): "A goodly oak, whose boughs were mass'd with age."

Scarlet Oak (Ben.): "King of the woods."

Blue Ash (Amy): "Thy guardian oaks, my country, are thy boast."

Silver Maple (Kate): "The monarch oak, the patriarch of trees."

Butternut (Burke): "The oak for grandeur, strength and noble size, excels all trees that in the forest grow."

Black Walnut (Frank): "Tall oaks from little acorns grow."

Buttonwood (Harrison),

"Woodman, forbear thy stroke!
Cut not its earth-bound ties;
Oh, spare that aged oak,
Now towering to the skies!"

Sassafras (Henry):

"Behold yon oak,
How stern he frowns."

Pepperidge (Walter): "The glory of the woods."

Buckeye (Samuel):

"Proud monarch of the forest!
That once, a sapling bough,
Didst quail far more at evening's breath
Than at the tempest now.
Strange scenes have passed, long ages roll'd
Since first upon thy stem,
Then weak as osier twig, spring set
Her leafy diadem."

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Red Oak (Lulu.): I begin to feel my pride rising and hope White Oak will give me a chance to quote a poem written in honor of one of our family.

White Oak: (Bows).

Red Oak:

"A glorious tree is the old gray oak;
He has stood for a thousand years—
Has stood and frowned
On the trees around
Like a king among his peers;
As round their king they stand, so now,
When the flowers their pale leaves fold,
The tall trees around him stand, arrayed
In their robes of purple and gold.

"He has stood like a tower,
And dared the winds to battle,
He has heard the hail,
As from plates of mail
From his own limbs, shaken, rattle;
He has tossed them about, and shorn the tops,
When the storm has roused his might,
Of the forest trees, as a strong man doth
The heads of his foes in fight."

Scarlet Oak (Otto): That poem which Red Oak quoted reminded me of an old saying of Dr. Holmes. He says: "I wonder if you ever thought of a single mark of supremacy which distinguishes this tree from those around it? The others shirk the work of resisting gravity, the oak defies it. It chooses the horizontal direction for its limbs so that their whole weight may tell, and then stretches them out 50 or 60 feet so that the strain may be mighty enough to be worth resisting. You will find that in passing from the extreme downward droop of the branches of the Weeping Willow to the extreme upward inclination of those of the Poplar, they sweep nearly half a circle. At 90 degrees the Oak stops short, to slant upward another degree would mark infirmity of purpose, to bend downward weakness of organization."

Black Oak (Ruby): What the Oak said sounds scientific. I want to tell you something that begins with "once upon a time." Once upon a time the devil agreed with a man that he should have the latter's soul at the time when the oak leaves fell; but when he came to look at the oak in the autumn he found it still in leaf, nor did it part with its old leaves till the new ones began to sprout. In his rage and disappointment he scratched the leaves so vehemently that they have been in consequence jagged ever since.

White Oak: These are certainly good words for the Oak family. We will next listen to some music from the little birds—our very dear friends.

White Oak: We shall next hear from the Maples, of which there are six in our State. They are cousins to the Buckeye, Bladdernut, and Box-elder, all of which belong to the Maple family.

Sugar Maple (Louise): I am a favorite ornamental tree. Poets of all ages have sung about the oak. I am no sweet singer of Michigan, but I am possessed of sweetness. I claim to have made more boys and girls happy than any other tree. I have many changes in dress—wearing in spring the softest shade of every color; in the summer the purest emerald, and in the autumn the most brilliant yellow. My wood is used for furniture, floors, and for furnishing the interior of houses, and after the houses are finished few can warm them better than I.

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Red Maple (Mary): I am often called Soft Maple, a name also applied to one of my sisters. I beautify the country in spring with early red blossoms, and in autumn my leaves are streaked with scarlet.

Silver Maple (Jennie): My sister Red Maple and myself are both called Soft Maple. I make a very rapid growth and am found by the side of streams. I am often planted as a shade tree, and in the far west many are planted for shelter belts and for timber.

Bass Wood (Maud): I am a fine shade tree, my home a moist, rich soil. My fragrant flowers furnish a great amount of excellent honey for the bees at a time when most other flowers have disappeared. My timber is soft, light and tough, and not apt to split, good for cabinet work, boxes, broom handles, etc.

Black Cherry (Ethel): With our beautiful blossoms we need not be envious of the orange groves of California. I am one large snowball of blossoms in the spring. My fruit is much liked by the birds, and my wood is fine, light, durable and looks much like mahogany. My cousins are the wild plum, crab-apple, mountain ash, hawthorn, Juneberry, spiræa, the apple, pear, quince, and the peach, and we all belong to the Rose family.

Black Walnut (Frank): I am not ornamental, nor am I a good neighbor, for I sometimes poison other trees that live near me. In spite of my bad qualities, I am liked because I can be converted into cash at any moment. Some of my brothers have sold as high as $2,000. Those who care for us care for a fortune. My relative, the Butternut, is much loved by boys and girls. It was round my brother at Haverstraw, on the Hudson, that Gen. Wayne mustered his forces at midnight, preparatory to his attack on Stony Point.

Hickory (Ray): There are four brothers of us in Michigan, but I am the least worthy of them all, and am the only one present at this convention. We are cousins of the Walnut and Butternut and all belong to the Walnut family. If you want a wood that is good for buggies, ax-handles, barrel hoops, a wood like iron, call upon my brother, the Shag-bark. You will have all the nuts you want thrown into the bargain. Once upon a time there was a president of the country who had so many of my qualities that they called him Old Hickory.

White Oak: We will sing about the "echo which in the forest dwells."

White Oak: We will next hear a few words from the Ashes. (Three rise and stand till all are through.)

White Ash (Myrtie): I am a tall tree and have often been complimented for my usefulness. I have been told that I have a graceful top and beautiful pinnate leaves. My wood is heavy, hard, strong, coarse-grained, compact, and of a brown color, and is much used for cabinet ware, farm implements, and house finishing. I thrive on rich, moist soil.

Blue Ash (Amy): I am not often found in Michigan. I grow slowly and attain a good size. My wood is valuable for lumber, posts and sills. I may be distingnished from all other Ashes by the square branches of a year's growth.

Black Ash (Ella): I thrive in swamps and along streams, and become a large, useful tree. My wood is used for furniture, barrel-hoops, and baskets. When well cared for, I become one of the finest ornamental trees. For this purpose I have never been fully appreciated. The Ashes belong to the Olive family. We have been called musical, as in this quotation:

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"Ye Ashes wild resounding o'er the steep,
Delicious is your music to the soul."

White Oak: Who will speak next? (A number rise.) Birch has the floor.

Birch (William): I am a useful factor in the cause of education, though not now so commonly found in the school room as in former years. There are five sisters of us Birches in Michigan. The Alders are our cousins. Probably you are best acquainted with the Canoe Birch, whose white wood you see in spools and shoe pegs. It gives up its beautiful white dress without any injury to itself. Longfellow has made us a celebrated family in Hiawatha. He says of us:

"Give me of your bark, O, Birch tree!
Of your yellow bark, O, Birch tree!
Growing by the rushing river,
Tall and stately in the valley!
I a light canoe will build me,
That shall float upon the river,
Like a yellow leaf in autumn,

Like a yellow water lily!
Lay aside your cloak, O, Birch tree!
Lay aside your white skin wrapper,
For the summer time is coming,
And the sun is warm in heaven,
And you need no white skin wrapper."

White Oak: Let us hear from the Elms.

American Elm (Lida): I have been called the Queen of the Forest, and stand without a rival at the head of the list of ornamental deciduous leaved trees. I claim this rank on account of hardiness, rapid growth, and the graceful and majestic beauty of my drooping branches. We are very proud of our Massachusetts relative under whose venerable shade Washington first took command of the Continental army, July 3, 1775. How the affection of every lover of his country clings around that tree! What care has been taken of it, what marks of esteem have been shown it by the citizens of Cambridge, may be judged by those who have seen it standing, as it does, in the center of a great public thoroughfare, its trunks protected by an iron fence from injury by passing vehicles, which for more than a century have turned out in deference to this monarch of the Revolution.

Red Elm (Claude): I am well known for my durable red wood and mucilaginous bark and am often called "Slippery Elm." My sister, Rock Elm, is a fine tree with corky branches, and the wood is valuable for farm implements.

Hackberry (Otis): I am one of the poor cousins of the Elms, and am little known. I am sometimes called the Nettle tree, and I am afraid Michigan people are not on speaking terms with me. Allow me to tell you about my German relative, the Luther Elm, near Worms. It is said to have been planted as follows: A bigoted old Catholic lady, thrusting a stick in the ground, declared her resolution not to accept the new faith till that dry stick became green. The fact that it did so proved the interest taken by trees in the preservation of orthodoxy.

Red Mulberry (Robert): I am another obscure cousin of the Elms and not often seen in Michigan. The birds are fond of my berries and the wood is as valuable as cedar for posts. Let me praise the Elm.

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"Hail to the Elm! the brave old Elm!
Our last lone forest tree,
Whose limbs outstand the lightning's brand,
For a brave old Elm is he!
For fifteen score of full-told years,
He has borne his leafy prime,
Yet he holds them well, and lives to tell
His tale of the olden time!"

White Oak: Let us all repeat the lines of N. S. Dodge in praise of the Queen of the Forest.

"Then hail to the elm! the green-topp'd elm!
And long may his branches wave,
For a relic is he, the gnarl'd old tree,
Of the times of the good and brave."

White Oak: We will have another song about the birds (or any other subject).

White Oak: We have heard nothing from the Willows.

Willow (Marion): I live near the water and my wood is made into the strangest things, artificial limbs, tooth-picks, ball clubs and gunpowder. Some of us are called "Pussy willows."

Elizabeth Allen has written this lovely poem to my sister the Weeping Willow of Europe, who has been for years mourning; something to us unknown.

"O, Willow, why forever weep,
As one who mourns an endless wrong!
What hidden woe can lie so deep?
What utter grief can last so long?
Mourn on forever, unconsoled,
And keep your secret, faithful tree!
No heart in all the world can hold
A sweeter grace than constancy."

The Poplar (Cara): There are five sisters of us Poplars who live in Michigan. One is called Cotton Wood, and two are called Aspens. We are cousins of the Willows and all belong to the Willow family. I will read some lines of the poets:

"Why tremble so, broad Aspen-tree?
Why shake thy leaves ne'er ceasing?
At rest thou never seem'st to be,
For when the air is still and clear,
Or when the nipping gale, increasing,
Shakes from thy boughs soft twilight's tear,
Thou tremblest still, broad Aspen-tree,
And never tranquil seem'st to be."

White Oak: We ought to hear from Red Bud and Sassafras and Pepperidge and Buttonwood or Sycamore, who live in our forests, but they do not appear to be present at this convention. Our exercises would not be complete without hearing from the members of the Pine family or cone bearing trees.

White Pine (Sylvia): I am one of the tallest and largest, most common, well known and valuable trees of the State. In Europe, where some of my number have been introduced, they often call me Weymouth Pine. My leaves are long, light green and in clusters of five. As a long-lived and

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beautiful tree for ornamenting rural grounds and parks, I take a high rank, while an immense amount of valuable lumber is cut from my wood.

White Oak: Let us hear from another pine of Michigan.

Red Pine (Naomi): I am often called Norway Pine, though I do not know why. I never lived in Norway, but am only found in North America. I am a tall, straight tree, with long evergreen leaves in clusters of two. I grow slowly, making valuable timber which is much harder than that of White Pine. For ornamental purposes I much resemble Austrian Pine, though much superior to that tree, if we rely on the opinions of noted horticulturists.

White Oak: The White Pine and Red Pine have a sister Pine in Michigan. We shall now give her an opportunity to speak.

Grey Pine (Rose): I am a tree of small size, found on poor land in Northern Michigan. When young my growth is rapid; my leaves grow in pairs and are quite short. My wood abounds in pitch. I am known by a variety of names, as Scrub Pine, Jack Pine, Buckwheat Pine, Black Pine, Crocodile Pine, but the name I like the best is Pinus Banksiana.

I want to tell you what Ruskin says. "The tremendous unity of the pine absorbs and molds the life of a race. The pine shadows rest upon a nation. The Northern people, century after century, lived under one or the other of the two great powers of the pine and the sea, both infinite. They dwelt amidst the forests or they wandered on the waves, and saw no end or any other horizon. Still the dark green trees, or the dark green waters jagged the dawn with their fringe or their foam, and whatever elements of imagination or of warrior strength or of domestic justice were brought down by the Norwegian or the Goth against the dissoluteness or degradation of the south of Europe, were taught them under the green roofs and wild penetralia of the pine."

White Oak: We have another cone-bearing tree in attendance. I call on

Hemlock Spruce (Agnes): I have been called by students in art and botany and horticulture "the most beautiful coniferous hardy tree yet known." I grow to a good height and acquire a large size. My evergreen leaves have delicate tints, my young branches droop gracefully. As a timber tree I do not claim the highest honor. My bark is valuable for tanning leather.

White Oak: There are two other sister evergreens called "Spruces" I see in the audience.

Black Spruce (Rhoda): I abound in swamps in Northern Michigan. I am often used for Christmas trees on festive occasions, and boys and girls search me over for a supply of first-class gum. I am not responsible, though, for all the gum that goes by my name. Within a few years my wood has been largely used to make white paper.

White Oak: I recognize another evergreen. I call on

Red Cedar (Clara): In summer my leaves are beautiful, but in winter they become brown. I am found only sparingly in any part of the world, though I am the most widely distributed of any tree in the United States. I grow slowly and produce a beautiful red, fragrant wood, which is soft and very durable. My wood is now mainly limited to the making of lead pencils.

White Oak: Let us next hear from

Balsam Fir (Alice): I am a rather small, slender evergreen found in swamps, though often cultivated as an ornament about dwellings. I arrive at my prime when about fourteen years old.

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White Oak: I shall now call on

Arbor Vitæ (Maud): I thrive in the swamps of the North and afford shelter to wild animals. I am often called white cedar and I furnish most of the telegraph poles, some fence posts, railway ties and blocks for paving streets. I take a high place as an ornamental tree.

White Oak: We have now heard from all of the cone-bearing evergreen trees who are present. There is another tree of the State, not here present, which is cone-bearing, and belongs to the Pine family. I refer to the tamarack.

There are some other matters appropriate to Arbor Day which should demand our attention at this time. How do the trees of Michigan compare in beauty and variety with those of Great Britain of which we read so much?

Susie: The farther north we go the fewer kinds of trees we find; the farther south, the greater the variety. Great Britain and Ireland contain more than twice the area of Michigan. They have one basswood, not so good as ours; one very small maple, one cherry, one small ash, two elms, two poplars, one beech, one small birch, one pine, one oak much like our white oak. Great Britain has about ten species of trees native to her soil, while Michigan, with half the territory, has about ninety species, or nine times as great a variety.

White Oak: For some interesting points in reference to nuts and seeds I call on

Red Maple: Last autumn the hazels, beeches, chestnuts, oaks, hickories, walnuts and buckeyes, matured their fruit, and with this maturing the burs, or cups, or husks, opened or the stems snapped in two at a joint which began to form months before. If a bur or nut held fast too tenaciously, the frost made it willing to drop, and down it went with hundreds of others, among the leaves.

The leaves, with the help of the shifting winds, gently covered the fruit—or some portions of it. The leaves make the best kind of protection from dry air and severe cold, and they come just at the right time. All the seeds are not covered, but Dame Nature is generous. She produces an abundance; enough for seed and enough to feed the birds, squirrels, and other animals.

White Oak: We want to hear a word about Nature's tree-planters, the squirrels, birds and other animals.

Basswood: The squirrels eat many nuts, but carry a portion to some distance in every direction, where they plant one or two in a place. It may be the thought of the squirrel to return at some future time of need, but his bump of locality is not well devoted or he has laid up more than he needed. At all events some of the nuts are allowed to remain where he planted them. In this way he is a benefit to the trees, and pays for the nuts which he eats. He has not lived in vain, for he is a tree-planter and believes in arboriculture. His arbor days come in autumn, and he needs no gubernatorial message to stimulate him to work.

White Oak: This subject will be continued by

White Spruce (Adeline): Many of our trees and shrubs produce a fleshy fruit or berry. Among them are the mountain ash, service berry, wild crab apple, hawthorn, cherry, holly, viburnum, pepperidge, hackberry, mulberry, sassafras, wild plum, persimmon, paw paw, cedars and junipers. Many of these when ripe are rendered conspicuous by brilliant colors. The fruits are eagerly sought by grouse, turkeys, deer, bear, or other animals. In most

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cases the seeds of such fruits are protected by a very firm covering and are not digestible. They are sown broadcast by wild animals under circumstances most favorable for germination. The birds, too, belong to the society of tree planters.

White Oak: We will next listen to some accounts of the wind as a sower of seeds.

Sassafras (Iona): Some trees produce dry seeds or seed-pods, and usually drop only a portion in autumn. They hold on to some seeds with considerable tenacity. Among these are the buttonwood, basswood, ironwood, blue beech, box-elder, hop tree, tulip tree, the ashes, catalpa, locust, Judas tree, birches, alders, larches, pines, spruces. The fruit or the seed is thin, or provided with wings, which distribute them as they fall, or after they have fallen. In winter it needs but a slight packing of the snow to bear up the seeds. At such times, some of the seeds are torn from the trees by the wind, and may be seen sliding along like miniature ice boats, often half a mile or more from the nearest tree. The wind also aids in transporting the seeds of our elms, maples, willows and poplars.

White Oak: Next listen to something more about seeds.

Red Bud (Cynthia): A seed is a young plant and is packed ready for transportation. It has a tiny stem, some seed leaves and a terminal bud. The mother tree, before casting off her progeny into the world, did not fail to give it a little outfit in the form of starch for food stored up in or surrounding the thick seed leaves. As the young chicks while in the shell are nourished by the yolk of the egg, so the young oak or maple subsists on the starch stored up before ripening.

White Oak: When do our trees make their growth and how do they get ready for the next year?

Box Elder (Nina): Most of our trees put forth their new growth during a few weeks in spring or early summer. Do you wonder what they are doing during the rest of the warm weather? They are by no means idle. They may be perfecting flowers and seeds, but all of them are getting ready for the next winter and spring. Through the influence of light and heat, the green leaves are forming starch which is transported and stored in the pith, young wood and bark. The young leaves and stems are started and arranged, packed in cotton, covered by scales and in some cases the scales are protected by pitch or varnish.

White Oak: Next in order will be a few words in regard to the tree as a community.

Buckeye (Douglass): A tree is a composite being, a kind of community by itself. The leaves and limbs are all the time striving with each other to see which shall have the most room and the most sunshine. Each strives for all it can get. While some perish in the attempt, or meet with only very indifferent success, the strongest of the strongest buds survive. Each leaf helps to sustain the limb which carries it, and each limb furnishes some nourishment to the common trunk for the common welfare. The tax is always adjusted according to the ability of each to contribute. As the limbs of a tree are striving for the mastery, so each bush and tree in grove or forest is striving with others for the mastery. The weakest succumb to the strongest; some perish early, some lead a feeble existence for many years, while even the strongest are more or less injured. With plenty of room, the trunk will be short, the branches many and wide-spread; where crowded, the lower limbs

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perish for want of light. Dead limbs fall to the ground to protect and enrich it for nourishing the surviving limbs and the trunk. The scars heal over, more limbs perish as new ones creep upward, and thus we find tall, clean trunks in a dense forest.

White Oak: To be successful, it is very important to know how to gather and care for seeds and nuts.

Yellow Wood (Robert): Gather the seeds or nuts of trees when ripe and, if convenient, plant them where the trees are expected to remain. In this list we include especially the trees which have long tap roots, and do not easily transplant, such as the tulip tree, the hickories, the oaks, the walnuts, and chestnuts. The seeds of elms and maples are not easily kept over winter. Seeds of evergreens, the larch, and the locusts may be dried and kept as grain is kept. Many seeds and nuts may be mixed with an equal bulk of sand as it is dug from a knoll, and buried a few inches or a foot below the surface. In spring they may be carried to the garden and planted. Soak seeds of locust and honey locust in hot water till the outer covering softens, and then plant. Soak seeds of evergreens three or four days in water, changed daily, and then plant very shallow in rows a few inches apart in rich loam, well screened by lath, brush or muslin. See that weeds do not rob the young plants of light, room and nourishment. Evergreens in small quantity, when small and two or three years old, can be purchased of experts more cheaply than they can be raised at home. These can be set in rows and cultivated for a few years like Indian corn. For further details you are advised to read copies of our State horticultural reports, take lessons of a nurseryman, or go to the Agricultural College.

White Oak: It is of little use to plant seeds or buy trees unless we know how to handle them while moving.

Kentucky Coffee Tree (Hiram): In taking up a tree, whether large or small, do not twist it about so as to break or bend the roots abruptly. Get all the roots you can afford to, remembering that a tree will not grow without roots.

When out of the ground keep the roots constantly covered with soil, moss, damp straw or something else. The roots are far more sensitive to dry air than are the parts above ground. No one need wonder that trees carted into town with short roots exposed to dry air, often fail to grow or lead a precarious life for years. Study the structure and the physiology of a tree and treat it as one who always makes everything thrive which he cares for.

White Oak: How shall we care for the trees after planting?

Apple Tree (Hannah): To set a tree so as to insure its thrifty growth, place it but little deeper than it was while growing. Have the soil well pulverized and pack it closely about the tree.

After all this trouble, do not court disappointment in the slow growth or in the death of a favorite tree, but dig or rake the ground every week or two, all summer from three to five years, for a distance of four feet or more each way from the tree. If this is impracticable, place a mulch of something covering the space above mentioned.

White Oak: After planting, trees sometimes become too thick. What shall we do?

Pear Tree (Andrew): A tree, like a child, is a living, organized being and keeps changing as long as life lasts. It is not best merely to set as many trees as we expect to remain for a lifetime, but plant them more thickly with a

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view to removal. Here is where 99 out of 100 fail. They do not keep an eye on the growth and trim or remove trees until they have crowded and damaged each other beyond recovery. In most instances, a few large, well developed trees should grow where many small ones were planted years before. It needs courage and judgment to remove some favorite trees that others may continue to spread and make a symmetrical growth.

White Oak: Next will follow something in reference to the flowers of trees:

Bitternut (Silas): With rare exceptions, our trees bear flowers which are inconspicuous. The elms and the maples produce flowers in spring before the leaves appear. Most have the staminate and pistillate flowers on different parts of the tree or on different trees. The wind or gravity carries the pollen to the pistil, so there is no need of sweet odors or a gay display of flowers to attract bees and butterflies and moths to carry the pollen. Compensation is well displayed in nature. If the tree has not gorgeous or fragrant flowers, it has a large size and often a beautiful form.

White Oak: We should learn to love trees and to associate them with the generous hand who planted and cared for them.

Wild Plum (Ezra): I will tell you something which was written by Washington Irving: "There is something noble, simple and pure in a taste for trees. It argues, I think, a sweet and generous nature to have this strong relish for the beauties of vegetation, and this friendship for the hardy and glorious sons of the forest. There is a grandeur of thought connected with this part of rural economy. It is worthy of liberal, and free-born, and aspiring men. He who plants an oak looks forward to future ages, and plants for posterity. Nothing can be less selfish than this. He cannot expect to sit in its shade nor enjoy its shelter; but he exults in the idea that the acorn which he has buried in the earth shall grow up into a lofty pile, and shall keep on flourishing and increasing and benefiting mankind long after he shall have ceased to tread his paternal fields."

White Oak: We will hear what O. W. Holmes says on this subject.

Tamarack (Elias): Dr. O. W. Holmes says: "I have written many verses, but the best poems I have produced are the trees I planted on the hillside which overlooks the broad meadows, scalloped and rounded at their edges by loops of the sinuous Housatonic. Nature finds rhymes for them in the recurring measures of the seasons. Winter strips them of their ornaments and gives them, as it were, a prose translation, and summer reclothes them in all the splendid phrases of their leafy language.

"What are these maples and beaches and birches but odes and idyls and madrigals? What are these pines and firs and spruces but holy rhymes, too solemn for the many-hued raiment of the gay deciduous neighbors?

"As you drop the seed, as you plant the sapling, your left hand hardly knows what your right hand is doing. But nature knows, and in due time the power that sees and works in secret will reward you openly."

White Oak: This concludes what we had on the program for this convention.

Hemlock: I move we have some more music and then adjourn.

White Oak: If there be no objections we shall have the music.

White Oak: This convention stands adjourned until again convened by the proper authorities.

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HARRISVILLE INSTITUTE.

THE PINE PLAINS OF MICHIGAN:—THEIR AGRICULTURAL POSSIBILITIES.

[Papers and discussions of the Institute held February 8 and 9, 1888, at Harrisville, Alcona county, Michigan.]

PROGRAM.

WEDNESDAY EVENING, FEB. 8, 7 P. M.

Prayer	Rev. F. N. Barlow.
Music	Glee Club.
Address of Welcome	President Farmers' Club.
Music	Glee Club.
Paper on Forestry	A. H. Spencer.
Lecture	Prof. Beal.
Music	Glee Club.

THURSDAY, FEB. 9, 9 A. M.

Farming Light Soil	J. VanBuskirk.
Preparation of Soil for Seeding	Donald McNeal
Sheep Raising	L. R. Dorr.

PLEURO-PNEUMONIA—DISCUSSION.

AFTERNOON SESSION, 2 P. M.

Fruit	Wm. C. Gray.
Ten Requisites to Success in Commercial Horticulture	Prof. L. H. Bailey, Jr.
Corn	B. P. Cowley.
Wheat	J. Martin.

EVENING SESSION, 7 P. M.

Music	Glee Club.
Reading	Mrs. VanBuskirk.
Music	Male Quartette.
Reading	Mrs. B. Bennett.
Agricultural Education	C. P. Reynolds.
Music—Instrumental	Mr. Mayo and Miss Reed.
Lecture	President Willits.
Music	Glee Club.

After the opening exercises the first session of the Institute was chiefly taken up by a running discussion following Dr. Beal's paper on Forestry, the text of which will be found in full in the proceedings of the Forestry Convention in this volume.

Mr. A. H. Spencer: If our forest lands are to be settled up, the timber must first be cleared from it, and this can't be done without fire.

Dr. Beal: Do you destroy the timber in clearing, or do you use it?

Mr. Spencer: We must burn our fallows when we can—not at permission of a warden. We must do it when we are at home from other jobs. Our justice of the peace, the supervisor, highway commissioner and pathmasters are authorized fire fighters. I would not want to settle in a country where I had to ask permission of any one to set my fallow to burn.

Prof. Beal: Do you ever back fire or clear strips to protect reserve timber?

Mr. Spencer: Oh yes, but the settler on new land has nothing to rely on

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but the ax and the fire. His wood must pay for his land and support him at the same time. I would have a law imprisoning outsiders who carelessly leave fires from their pipes or cigars or camp fires that spread. Railroads cause a good many fires.

Dr. Beal: What will we do for timber 50 years hence?

Mr. Spencer: We can't look that far ahead.

Dr. Beal: Do hired men ever set fires in green pine for the sake of getting a job the next winter?

Mr. Spencer: I don't know. Money will do most anything.

Prest. Willits: I do not understand Dr. Beal to oppose the settler's clearing his land, but to advocate that for public and private interest each man should see to preserving a good wood-lot. So the settler is just as much of a criminal as the land-looker if he starts a fire that injures his neighbor. Fire uses up more pine than the sawmill.

Remember the fearful destruction of the fires in Tuscola county in '82. The principle involved is the protection of the community against the folly of the careless by putting some man, the choice of the community, as a prudent one to decide when the public welfare would be endangered by fire.

Dr. Beal: This work need not be confined to the supervisor, but may be intrusted to fire wardens, deputies appointed by him.

Alcona County.

President Willits: I want to ask some questions about this county. I see you have about 20 townships. What is the prevailing wind?

Answer: S. W.

President Willits: Do you have northeasters?

Answer: Yes.

President Willits: In the spring?

Answer: Usually, at least one, lasting often three days in May.

President Willits: What is the annual rainfall?

Mr. Thayer: About the same as at Lansing.

President Willits: How deep do you dig for water in the village?

Answer: Twenty feet in high ground, 20 to 40 feet a mile back, 16 to 40 feet 5 miles west of here.

President Willits: What soil is that through?

Answer: Loamy sand, hard near the surface, then shale or clay and then sand. The water is hard.

President Willits: Is there any part of the county where you can't get water?

Mr. Van Buskirk: I believe near west Greenbush, two miles from the lake, they went 100 feet without getting water.

President Willits: What time does winter set in?

Mr. Van Buskirk: Frozen weather November 15, and sleighing snow about Christmas. We have several times gone to town meeting on sleighs, but are apt to lose sleighing by March 20. Land does not freeze deep, snow protects it, snow is deeper in openings than in woods.

Prest. Willits: Do you have frosts in the summer months?

Mr. VanBuskirk: I planted beans June 15 and had a good crop. We do not grow winter wheat much. We have to put our crops in two or three weeks later than in south part of State, but the crops grow more rapidly with us and our harvests are not more than five days later.

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Prest. Willits: What is the general character of soil of the county?

Mr. VanBuskirk: We have heavy clay, sandy loam and indeed almost all kinds. The predominant soil is sandy loam.

Mr. ———: I should say clay loam instead of sandy loam. We have very little, if any heavy clay. Any that we have has enough sand to slack when turned up to the weather.

In the lake tier of townships the farming lands come to within from three miles to one and one-half miles from the shore, the rest being light towards the lake.

Prest. Willits: We came down a long hill a couple of miles back, what is the soil of the hill and of the flats this way of it?

Answer: The hill is clay loam; the flats are black, mucky soil.

Prest. Willits: What is the timber of the county?

Mr. VanBuskirk: Twenty-five to 30 % beech and maple, some red oak, considerable birch, 60 to 75 % Norway and white pine (more white than Norway); very little Jack pine in strips two miles from shore and some in west part of county.

Prof. Bailey: Have you wild grapes?

Mr. VanBuskirk: We have no wild grapes. We have abundance of raspberries, black and red, and blackberries, and they project above the snow and do not winter-kill much;—31° is the coldest we have noted. Sandy loam is underlaid by subsoil of clay that frequently clings to roots of stumps as we dig them.

Adjourned to 9 A. M.

FEB. 9, 1888, 9 A. M.

Thermometer—23°.

Mr. J. VanBuskirk presented a paper on

FARMING LIGHT SOILS.

I would first ask, are you qualified to sit on a jury and give an unbiased and unprejudiced verdict as to the relative values of light and heavy soils, or are you wedded to a soil that sticks to your boots and makes the good wife wear a scowl whenever you enter in upon her clean kitchen floor? The prejudice against light soil has been so marked that when a man settles on a sand farm he is given over by his heavy soil neighbors to starve, and is given just eighteen months to make his funeral arrangements. I will not make the assertion that light soil will produce more bushels of grain to the acre, or that all light soil, such as the white sand plains with no subsoil, can be farmed successfully without a considerable capital to put it in shape; even then I doubt if it would cost more than it costs to put heavy timbered land in shape for crops. It is my opinion that God made sand for farming and clay for brick. I have been working on that principle. The poorest of light soils, the sands of Holland, which were washed up from the sea, have been made into fertile farms; what was considered absolutely worthless once, is now worth several hundred dollars per acre. In Alcona county we have a variety of light soils; we have white sand, believed to be the least fertile, yet my wife always takes sand off the beach to start plants in pots. We have red, gray and black sands, and all are capable of producing good crops of wheat, oats, hay, and potatoes, in fact, anything suitable to the soil and climate.

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Gravelly soil is simply a coarse grade of sand, and is the surest wheat land we have. The grain raised on it is plump and of the finest quality. Light soils stand a drouth better than heavy; it drinks in a shower and holds it for use, when but little of it penetrates clay soil, and after a day or two you can work the light soil when work is impossible on clay soil. After a dry season clay is so hard when breaking up season arrives that you can't get a plow point sharp enough. Light soils, too, can be worked earlier in the spring, and seed germinates more rapidly in light than in clay soils, and as for potatoes, who would ever think of planting them on clay if he could find a piece of light soil on his farm. The only real good use I have for clay, outside of brick, is to make cesspools for liquid manure of the barnyard.

When my father came to western New York, about the year 1800, the light soil was not considered worth locating, and when I left there in 1852 to come to Michigan, the most valuable farms were the sand farms. Some say it costs so much for manure, etc., to keep sand farms up. You must not expect to take crop after crop from land, selling the hay and straw off the farm, or you will be classed among the robbers and will suffer the penalty of your folly. Even clay land would not stand that treatment. To succeed on a sand or a clay farm you must be honest with it, and give it a fair show; give it a rotation of crops and then let it rest. Sod ground should not be pastured so close but that a good coat of clover can be turned down.

Divide your farm into fields. Begin the first year by planting field No. 1 to peas; field No. 2, oats; field No. 3, barley or spring wheat; field No. 4, meadow; field No. 5, pasture, with a piece of new ground for potatoes and rutabagas. The first year No. 3 should be seeded down, fall plow No. 5, turn cattle into No. 4 three or four weeks after haying.

The second year plant field No. 5 with peas, No. 1 with oats, No. 2 with barley or spring wheat, use No. 3 for meadow, No. 4 for pasture; fall plow No. 4 and seed down No. 3, and so on, unless you choose to mow one field two years instead of one. The sod ground that is fall plowed should not be pastured so close but that a good coat of clover can be turned under.

For sandy soil I would sow one-third timothy and two-thirds clover, after the grain has been drilled or harrowed in, and roll the grass seed in without harrowing. Use what manure you have for top dressing the oat ground each year before seeding.

The pea ground having been plowed in the fall, draw the manure which is well rotted on the plowed ground, and deposit in heaps in the fall to be spread in the spring before cultivating for oats.

I have had experience and am prejudiced in favor of light soil farming. It costs no more to keep up than heavy soil. We have a hardpan subsoil to our light soils, two feet down, when the roots can reach clay. We turn under clover, and keep stock to make barnyard manure.

Dr. Beal: I remember the farm of Darius Comstock, near Adrian, north of the Raisin river, that was sand clear down, and I asked as to their success compared with clay farms. A friend who had grown up on a level clay farm thought himself fortunate in having sold it and got on to a sandy farm. Sand land does not need ditching or tiling. It is quick and responsive to manures and is easy to work. Orchards on such land are apt to be shorter-lived than on heavier land.

Mr. Van Buskirk: Winter wheat does not ordinarily succeed with us unless in sheltered spots. Peas following sod prepare the ground perfectly for

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oats. Peas yield 25 bushels per acre. We use them to feed stock after grinding or soaking. Without this they make the animal's teeth sore. We use them for horses with oats, pound for pound, in place of corn. Potatoes are the best first crop for new ground; they are apt to be scabby on older ground, the result of excessive manure.

Professor Bailey read an extract from a New York Professor of Horticulture as to scabby potatoes on muck, sand, garden soil and clay, the scab increasing in the order named. There was more scab on wet soils and on heavily manured lands. In a trial of 45 varieties of potatoes, of which 15 were dark colored, 15 light and 15 flesh colored: Of the dark 27% were scabby, of the light 43 %, of the flesh colored 53%. The scab is thought to be produced by a rupture of the skin, not by a fungus. Knabe of Germany agrees in the opinion that wet soils make scabby potatoes.

Pres. Willits: You raise potatoes on new ground. Have you tried potatoes on old ground?

Mr. VanBuskirk: Yes, not on sod land.

Mr. Beaver: I have on sod land. It is next best to new land. I have raised on new land 350 bushels per acre. The work has to be done by hand.

Mr. Cowley: My best potatoes were on six year old land; 400 bushels per acre. Burbank Seedling following corn on sand soil. The rotation from the first was fall wheat, meadow three years, peas, corn, potatoes, clover and timothy.

Prof. Bailey: In west N. Y., beans are very largely grown to feed.

Mr. VanBuskirk: Probably because they can't grow peas. When peas can be grown they are a much easier crop than beans or corn. Prepare ground as for any other grain, and after putting them in there is no more labor till harvest, when you roll them and cure by turning once or twice, then haul and thresh same as any grain.

Mr. Beaver: A neighbor got 32 bags marrowfats from two acres.

Mr. Cowley: I got 58 bushels from two acres.

Mr. Wm. C. Gray: As long as the soil has a good clay sub-soil, it will grow good marrowfats. They require a strong land and would be useless on light lands. My best crop was 42 bushels per acre. Smaller peas will grow on lighter soils. Green peas will do as well for seed as ripe peas. If farmers could afford it, peas will improve even a light soil. I use of large peas two and a half to three bushels seed per acre, plowing two to five inches deep. They should be plowed in, not harrowed in.

Prof. Bailey: Have you grown vetches?

Mr. Gray: Not in this country. In Ireland we used them to make a stolen crop between two other crops. I never knew of vetches being plowed in. The farmers keep on the average a cow for each four acres, and young stock enough to make one head for each acre. The vetches are cut early in April, and fed in the yard to the stock. Rape and late turnips are pastured off on the land by sheep.

Mr. C. P. Reynolds: Vetches or tares are used largely in Canada for forage, I think alfalfa is better.

Pres. Willits: Your chairman says the most successful farming is in connection with cattle. I have much faith in this northern country and have the expectation that it will be a dairy country, and for that reason I asked last night as to your water supply, for you cannot have stock without water. I feared there were large stretches of land where you could not get water

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without digging 100 or 200 feet. Of course there are such spots almost anywhere, in the southern part of the State, as well as here. Then the question of rainfall is of importance. I am told you have 25 inches. If that is well distributed through the season it is plenty. In California 17 inches is enough.

The next question is, will grass grow? If grass will grow it only needs good farming to make good farms. In Crawford county we found they had trouble with clover, *if sown in spring*. The season from winter to summer was too short for clover to start. But there they found they could start it in the fall successfully. So if you can grow clover, then by plowing it in or by feeding it to cattle, or by both, you can build up and permanently sustain the wealth of your land, and there is no doubt of it. In the southern part of the State clover is our main dependence, but it is essentially a three year plant. We can't do well with alfalfa. In California they can, as it is a seven year plant. Now if you can raise alfalfa it will save you frequent seeding and give you an alternative for clover. If you can raise either you can make this a good dairy country. But you say, why raise cattle when you have to stable them six months? In California they have no barns, no need of them. But yet for all that, in all that country of grass-fed beef I did not taste a good pound of butter or a good beefsteak. The meat is dark, like venison. The chickens have no light meat, and so for some reason you will find that the dairy business is not a business of open winters, but of the land of barns and of cold winters, the north temperate region. And there is no reason why you should not become famous as the dairy region of Michigan. Now I want to have a full account of what you can do here with clover.

Dr. Beal: I imagine from what I have already heard, that there is no trouble about clover here. Your land has had heavy timber growth, either hard wood or white and Norway pine.

Dr. Campbell: Does alfalfa produce large crops?

President Willits: Yes, it must be often cut.

Mr. P. C. Reynolds: I have had correspondence that has inclined me to alfalfa, as it has deep roots 10 to 15 feet. I farm on the plains land. A Kansas man told me that my soil is like his on which there was alfalfa. That he pastures in spring and fall and cuts three crops during the season.

Peter Henderson says on Long Island they pasture it spring and fall and cut two crops. It is not adapted to clay but is to sandy land. Best seed comes from Utah.

Mr. VanBuskirk: As to the length of time that we are compelled to house cattle. It is more profitable to house cattle than to pasture them even in summer, as the cattle do not then tramp or spoil their food and we can keep more head per acre.

SHEEP FOR THE PINE LANDS OF NORTHERN MICHIGAN.

[BY L. R. DORR.]

The first essential to successful sheep raising, is a *large range*.

The second, is, that the land must be dry. The sheep is an animal that bites close, is of a roaming disposition, and likes a variety of food.

Although clover, and grasses of that nature, suit them best, yet they *can* subsist on poorer grasses, briar brush and weeds, and do well, and no animal aids the farmer so much in clearing land of briars, and other foul undergrowth.

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It is an old German maxim, "That where geese will fly, sheep will die." Wet lands are not adapted for sheep, but are very suitable for geese. Most persons have noticed that sheep always sleep nights on high, dry ground if it can be had. Foot rot among sheep is the principal disease, and is caused by low, wet ground. Our stripped pine lands are well suited to sheep raising. These lands can be bought at 50 cents per acre, and produce a kind of grass, called Buffalo, or bunch grass, that is very nourishing to sheep, cattle and horses.

Some one has said, that the sheep has a golden foot. Wherever he goes white clover springs up, and weeds, briars, and rubbish disappear like magic.

Let a man plow his land which he wishes to cultivate, then provide himself with a portable fence, in sections that may be easily moved, and with it fence in one-half an acre, or enough for 500 sheep, and confine them for one night, or longer if he requires more manure, and he will find deposited a top dressing sufficient and ready for any crop. That land is ready for the seed, and should be sowed at once, for that manure is utilized and ready to feed plants.

Dr. Beal: When can Mr. Dorr turn out animals for spring pasture?

Mr. Dorr: May 15, for grasses.

Dr. Beal: About the same as in the southern part of State.

Mr. Beaver: I should say May 1.

Dr. Beal: How late can you pasture?

Mr. Beaver: First of November on the average.

Mr. VanBuskirk: I think we do not have to fodder much later in the spring than in the southern part of the State.

Pres. Willits: The world is finding that to get the best results from cattle you must coddle them. As the chairman says, you can keep more cattle by keeping them in the barn and mowing for them. They are domestic animals and do best when best cared for by men.

Dr. Beal: Does Mr. Dorr mean by the fifty cent land, the plains land?

Mr. Dorr: Yes, I mean the stripped plains land. Though it is not good to have burned logs and stumps, as it blacks the wool and injures it 2c per lb.

Prof. Beal: What grass does Mr. Dorr mean by bunch grass?

Mr. Dorr: It is a tuft of grass six or eight inches high that sends up a few stalks two feet high. They do not make a sod. It grows on plains, not on timbered land.

Prest. Willits: Does not cultivation kill bunch grass? Is it not a wild grass that will not grow under culture?

Dr. Beal: Bunch grass and alfalfa, too, require a good many years to do well. The wild grasses of the west are dying out and will have to be replaced by better grasses.

Mr. Dorr: I believe that bunch grass if plowed is killed. I would follow the loss of the bunch grass with red or white clover. I think the sandy lands just the place for clover. It heaves out on my clay farm.

Mr. Reed: We have very little "plains" land in this country like the Sable River plains. The soils on the plains vary greatly; some have a good clay subsoil, some abound with small shells and each produces different timber and different grass. There is a wide bladed grass that grows among black oak. Clover will grow there, but it must be cared for, and dry falls sometimes injure it. The lands that have yellow pine have a clay subsoil.

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Mr. Spencer: I have sowed clover here, and the first crop of June clover was so heavy I could hardly cure it. Last spring I sowed early on winter rye, and it did well. Soil, sandy loam with clay bottom.

Mr. P. C. Reynolds: In June, '87, a small portion of treeless plain north of Au Sable River was plowed (the soil a red sand covered with bunch grass), sowed to buckwheat and seeded with clover. Although the season was extremely dry, the buckwheat matured and the clover grew well. These plains seem different and better than the plains on the south side of the river —the sand packs. The land was probably originally covered with Norway pines felled by the wind and burned clean, stumps and all. The bunch grass took root excluding all brush or foul weeds, leaving it sole possessor. The south side plains, on the contrary, are covered with jack pine. The sand is white, drifting like beach sand, and will not pack. Surface is covered with sage brush and huckleberry. Some efforts to farm these plains south of the Au Sable have been made, but were unsuccessful, possibly because the men did more hunting than farming. They have three dogs to each house on the average.

2 P. M.

Beautiful specimens of Wagener, Spy, Baldwin, Fall Pippin, Golden Russet and Ben Davis were exhibited by Mr. Wm. C. Gray, Mr. Geo. H. Blush and Mr. Spencer. There were samples of corn, Red Blaze, by Mr. Cowley.

FRUIT IN ALCONA CO.

[BY GEO. H. BLUSH.]

I have been asked to write a paper on fruit of which I know but little, except by a small amount of experience. Fruit has been but little grown in Alcona county; still at our annual fair last fall there were fine apples, pears, plums and grapes. In the spring of 1862 I planted a small orchard of 18 trees on sandy loam and gravel, one mile and a half south of here, near the lake, of the following kinds of apples: The Rhode Island Greening, Baldwin, Spitzenberg, Sweet Bough, Sour Bough, Fall Pippin, Red Astrachan, and Northern Spy. Seven of the lot are dead, and all the rest of them are fast passing away with the blight and scab, except the Northern Spy and Red Astrachan, so that it would seem that these two kinds are the only ones in the lot that are adapted to this climate and soil.

There is one great trouble with our apples, the coddling moth or other insects; no one, I think, has ever tried spraying them with Paris green; plums of most any kind do well in this county, the insect has not found them so far north.

Have tried the Rareripe peach with poor success; trees grew to medium height, bore fruit twice; and winter killed.

I found the season too short and cold for the Isabella grape, they would not ripen.

I think I brought the first strawberry into this county, the Wilson's Albany, in 1862; they do well here. Other varieties have come, still I have the Wilson as a favorite.

Prof. Bailey: For Alcona county I would recommend the planting of the following varieties:

Apples: Oldenburgh, Astrachan, Fameuse or Shiawassee, Yellow Transparent Crab, Alexander, Talman Sweet, Stark, Russell, Northern Spy.

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Grapes: Moore's, Worden.
Plums: Newman, Wild Goose, Parson's, Lombard, Washington.
Raspberries: Hansell, Turner, Cuthbert (Red), Ohio, Souhegan (Black).
Blackberries: Tyler, Stone.
Currants: Victoria.
Gooseberries: Downing, Smith.
Strawberries· Crescent, Cumberland Manchester, Mt. Vernon.
Cherries: May Duke, Morrello, Early and Late Kentish.
Pears: Bartlett.

I fear the time will come when plums will not be successfully grown here. The rotting of the fruit and the premature falling of leaves, caused by fungi, which is troubling us in central Michigan, are working northward, and it is only a question of time when it will reach Alcona county.

Mr. ———: What is the remedy for borers in apple and cherry trees?

Prof Bailey: There is the flat-headed borer which works just under the bark and the best way is to dig out and kill and to wash the tree trunks in June with soap suds and dilute carbolic acid, which will keep off new comers.

Mr. Van Buskirk: There is no question but that we should select hardy varieties for our climate. The Rhode Island Greening and Baldwin I have found to be not hardy in this climate. They kill out. We can grow plums very well thus far, of the European varieties. The Morello cherry is our hardiest and best.

Prof. Bailey: I am asked why I did not recommend the Ben Davis. It is because I thought your climate would admit of your growing good varieties, which the Ben Davis is not. It is hardy but no better than a pumpkin.

Mr. Spencer: I have raised fruit trees here and in Macomb county, and find no more trouble here than there, and believe anyone can raise fruit here as well as anywhere. I have lombard, yellow gage, and yellow egg plums, the latter not as thrifty as the former.

Prof. Bailey: I see your fruits are of unusually fine color.

Mr. Dorr: I have not had much experience, but it has cost me dear. I bought 76 trees and have 11 left of the original lot. I have Astrachan, Alexander, Oldenburg, Golden Russet, and Snow, and those I find trustworthy. A few years ago I set out two acres, including nine Fall Pippins, and they are all dead; one-half of the Northern Spy and Ben Davis are dead, but the Tetofsky are alive. My pears live two or three years and die. I don't cultivate after July. They grow four miles back from the shore. Wageners are short lived, and Talman Sweets die.

Mr. VanBuskirk: As to keeping fruit, we are troubled with it withering. Prof. Bailey asked me if my cellar had a cement bottom. It has, and he said to keep them on earth bottom, they need moisture.

Secy. Reynolds: Golden Russets may be buried like potatoes.

Prof. Beal: One of the best fruit cellars I ever saw had a stream of water running through it. Burying in sand in the cellar is an excellent way.

Mr. VanBuskirk: How keep cabbages?

Prof. Bailey: We kept 200 head last winter. Grow them late so they will mature late. Dig eight inches deep on a sandy slope, set in the cabbages bottom up and put a little straw on, and after a few frosts put on a little earth, and as it gets still colder add a little more earth.

Prof. Beal: As to scabby apples, they are more common when there is little circulation of air and insufficient pruning.

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CORN.

[B. P. COWLEY.]

For this locality I would not recommend raising corn in large quantities. I have successfully grown Early Compton, White Flint, and early Red Blaze. The latter is recommended because it is not only early but it will endure a degree of cold and wet that would prove fatal to other varieties. I have raised more bushels to the acre of early Compton, but one year with another don't think it is as sure to ripen as Red Blaze. I plant from 15th to 20th of May and recommend rich, warm alluvial soil worked as deep as possible. I plant in rows 3 feet 3 inches apart each way, from 5 to 7 kernels to the hill are required, making about 8 quarts to the acre. To guard against crows and blackbirds I recommend rolling the grain before planting in land plaster in which a little tar has been mixed, and on light soils use a small quantity of bonedust or superphosphate as a fertilizer, about a teaspoonful in each hill.

Mr. VanBuskirk: I would like to ask the best outside fertilizers for our light lands.

Prof. Bailey: Barnyard manure and green manure and possibly salt—not lime—land plaster is useful only for clover. Farmers often sow it too thick. It is very insoluble, and your year's rainfall will only make use of a small amount per acre, so that a light application is worth as much as a heavy one.

Mr. Owen: I have raised corn here and in Ohio, and think Dent as sure here as there if properly treated. There is land that is too heavy to grow corn. I raised Ohio Dent, Michigan Dent and Yellow Hathaway, and got 180 to 200 bushels ears per acre.

COUCH GRASS.

[BY MR. JAS. WILLARD.]

Couch grass is variously called Quack, Twitch, Quick, Witch-grass, etc.; but it is known to botanists as Triticum repens, and is closely related to the wheat plant (Triticum vulgare). Couch grass is excellent food for stock, and is extensively used as such in European countries. By us, however, it is regarded as a "weed," because it is hard to kill. It propagates itself like the Canada thistle—both by seed and root—and the methods of treatment are for the most part identical; but it has even greater tenacity in the soil than the thistle. It thrives in any soil and in any climate in which the ordinary agricultural plants grow. The runners are provided with joints, out of which buds develop, and each of these will grow, even if the runner is torn into many fragments. It can be exterminated by a heavy dressing of mulch, which will smother the weed, but it must be thoroughly done; for half killing seems to give it double life. On a large scale, summer fallowing is usually the promptest and most effective method, but where there are many stumps, stones, roots, or fence corners the summer-fallow cannot accomplish much, for a very small root will make a big spread in a short time. In such cases, a hoe crop will prove the most effective. In any case, the plant should not be permitted to see daylight; for only where there is no breath, will there be an end of life.

For summer fallowing plow as shallow as possible the first time, for it will dry out much sooner and there will be less soil to tear the roots from. Plow deeper the second time. Afterwards deep cultivation is not necessary, the

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gang plow and the cultivator then being sufficient. It is not desirable to manure heavily while the work of destruction is going on. If the seeds are allowed to ripen, look out for a spread the next season. If the products of the field are fed to the stock, the manure should be thoroughly fermented in order to destroy the vitality of the seed. Many seeds will germinate even after passing through the bowels of the animal.

Dr. Beal: I have killed it in a dozen patches. Plow in the fall as late as you can and cultivate in the spring as soon as you can, whether muddy or not and cultivate thoroughly every three or four days till the middle of July and the job will be done.

Prof. Bailey: Has Hungarian or millett been tried here?

Mr. Alex. Tuill: I have grown millet successfully.

Mr. Spencer: I have grown Hungarian.

Mr. Gray: You can raise heavy crops of both here, but I think them hard on the soil. Perhaps it would be less so if they were not allowed to ripen the seed.

WEDNESDAY, 7 P. M.

The final session of the Institute was enlivened by an agreeable literary and musical program, of which Mr. P. C. Reynolds' plea for Agricultural Education in the Common Schools was the principal feature. This was followed by an account of the Agricultural College by President Willits and the Institute then adjourned.

ADRIAN INSTITUTE,

AND FOURTH ANNUAL MEETING OF THE

MICHIGAN DAIRYMEN'S ASSOCIATION

HELD AT ADRIAN FEB'Y 14, 15 AND 16, 1888.

As the proceedings of this convention have already been published by the State in full in a separate volume, only two articles besides the papers by those especially connected with the Agricultural College are here given. Copies of the Report of the Michigan Dairymen's Association can probably be obtained by application to the secretary, Mr. E. A. Stowe, Grand Rapids.

The following report is condensed from that volume:

ADDRESS OF THE PRESIDENT.

[HON. GEO. B. HORTON, OF FRUIT RIDGE.]

It is with pride I address you in this, our beautiful city, the capital of Lenawee, a county which for several years has occupied the enviable distinction of producing more value in agricultural products than any county in the United States. I am also glad to meet you in the vicinity where first the great industry you represent gained a footing in Michigan. * * * *

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From small beginnings the business of dairying has spread over the State until now we number over 100 cheese factories, and as many creameries, and nearly all sharing a good degree of prosperity, and as years come and go are becoming more firmly fixed in the line of mixed farming, as among the safest branches to patronize. In localities where there are no cheese factories or creameries, the farmers in general are awakened to improved methods of feeding, milking, milk setting, churning, etc., and many private dairies command best prices for their butter. Statistics of 1886 show that there are in Michigan 433,000 milch cows valued at $13,000,000, equal to the value of all other cattle combined, and one-third more than the value of both sheep and hogs. Our dairy products sell for about $15,000,000, an amount equal to the entire wheat crop, and one-third more than the value of corn.

I congratulate the dairymen of Michigan on their past good judgment in sustaining the character and quality of their butter and cheese. Michigan full cream cheese finds a wide market outside our own State. At times the inducement has been strong to make butter first and cheese from what was left, but as we watched other States in these methods, we gradually but surely became confirmed in the honest full cream cheese.

I hope that every dairyman will so manufacture and place on the market his goods, that the fact of their being made in Michigan will be a guarantee of perfectness and honesty. It will surely win in the end. By the most perfect process, try to make nothing but clean, fine flavored butter, and by all means make nothing but full cream cheese.

Dairymen should be consistent, and not like our brothers in the proud State of Ohio, go frantic over the frauds of oleomargarine, and various brands of bogus butter, while at the same time encouraging and assisting in the enactment of a law which is understood to mean that a cheese to be entitled to the legal brand of "cream cheese," must have at least one-sixth whole or unskimmed milk in its manufacture. We need pure food laws, but honest ones, and no interest should be allowed to pervert them. The Ohio pure food law, of which the matter I have just spoken of is a portion, is undoubtedly well intended, and a move in the right direction, but the dairymen were too selfish to be honest. The law gives especial attention to all brands of bogus butter, adulterated cheese, milk, vinegar, malt liquors, candy and colored sugar, cream of tartar, baking powder, etc., all furnishing a fruitful field for reform.

To carry out this law a commissioner is appointed with power to appoint three assistants. By their reports much good and effectual work has been done. Their main effort is to enforce the bogus butter portion, and they have succeeded admirably. The three factories that were in operation in the State have quit the business, and all who sell comply with the law, the trade therein being very much reduced. The pure food bill now pending before congress should receive the support of this body, as being in the interest of right, and to prevent fraud. Through it we may be able to prevent the five-sixths part skimmed cheese from Ohio coming into our State as cream cheese. While great improvement has been made in the quality of butter, and manner of sending to market since the creamer system was introduced, there is yet opportunity for great reformation.

Inasmuch as butter substitutes are and in all probability always will be manufactured and sold, I deem it of the greatest importance that the pure article should excel the bogus in quality, and equal it in appearance on the

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market, else the cheaper article will in time find more favor with purchasers. Much butter still goes to market in very bad condition, and often most anything else is preferable to the consumer. In this particular the Ohio Dairy and Food Commissioner made a serious mistake in exonerating the farmers from all blame, when it was reported to him the condition of quantities of farm butter, as it appeared on the market, in unclean packages, with a bad taste. He says they often *ignorantly* pack it in firkins which make it taste bad, and keep it where the odors of fish brine, coal oil, rotten potatoes, etc., affect it.

The farmers *ignorantly* do this. Then they are in the fault, and need to be more careful in these particulars. They should thoroughly understand that their butter sells on its merits as it appears on the market, and if a substitute looks cleaner and tastes better, there are many who will prefer it. The true fault should have been pointed out by the commissioner, and action taken to correct the evil. Taffy wont do it.

The national law placing the manufacture and sale of butter substitutes under the control of the revenue department, has been in operation over a year, and we can now form some opinion as to how much the dairy interests have been benefited thereby. It is difficult to complete statistics, as no authentic report has been published. It is calculated that just previous to the law taking effect, there were 80,000,000 pounds of these substitutes made annually; of this there was shipped to Europe in various forms 50,000,000 pounds, leaving 30,000,000 pounds for home consumption. It is safe to say that the tax has reduced the manufacture fully two-thirds, which would leave an annual home consumption of 10,000,000 pounds, and the amount of 20,000,000 pounds, which may now be supplied with pure butter, an advantage to the dairy interests of that amount. The internal revenue office reports an income of $1,083,734 from the tax for the whole time the law has been operative, but the amount will grow much less from now on, as many who took out licenses to sell at the beginning, would not now. They found that it would not sell so readily when purchasers knew what they were buying. Of the amount of bogus butter made during the year just past, much the larger portion went to Europe, but as England has now passed laws regulating the sale thereof, even more strict than ours, the manufacture in this country will be still further reduced, and the export trade of genuine butter increased in proportion.

The operation of the law has proved to be a great advantage to butter makers. Dairymen should he on the watch to keep the traffic under the control of the revenue department. An effort is now being made to reduce the tax, which possibly, in justice to all, should be done. It is the fraud features of the business we must be most tenacious in wiping out. I believe all fair-minded dairymen should be satisfied if the imitation article is sold by its right name. The competition on its merits we should never fear. In order to effectually carry out the national law, each State should enact similar ones and place in the hands of the proper authorities, who will see that no guilty man escapes. This association should speak out on the question. In former communications I have alluded to the necessity of the State assisting in solving some of the perplexing questions which surround the dairy. Through a systematic course of experiments only, can facts be ascertained and causes positively found. The making of butter and cheese, involving so many mysterious changes and developments, and the whole process so easily in-

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fluenced by surrounding circumstances, furnishes a wide field for experiments. Many are the cases of great loss to the dairymen, caused by too little knowledge of all these complications. The Hatch appropriation bill is now a law, and Michigan receives $15,000 annually for experimental work pertaining to agriculture. It is now about the only branch of farming not represented by experimental work at State expense, and no one branch furnishes a broader field for useful labor. Its growing importance now calls for attention, and the Michigan Dairymen's Association should ask for due consideration of their interests. The national appropriation makes it possible. The principal dairy States all have experiment stations, and some go further, and to impart important information, an expert is sent out to visit all the creameries and cheese factories, giving assistance on disputed points, and taking notes as to condition of buildings, utensils, ingredients used, cleanliness, etc. I think such a course must have a healthy effect and insure a uniform system of work on most approved methods. I recommend this subject for your careful consideration and action. The disease, or cattle plague called pleuropenumonia, which in the years past has caused so much anxiety, among stockmen and dairymen, throughout the States, is nearly annihilated. Prompt action by congress in creating the bureau of animal industry, and the efficient work of Commissioner Coleman, have saved unknown wealth to the farmers of our country. Quarantine is now raised from most sections, and during the year of 1887 there were only a very few cases in the States of Maryland, New Jersey, and New York. Prompt action prevented further spread. The dairymen of Michigan should feel gratified to have escaped the terrible scourge that might have been.

Where it had gained footing it was at an enormous expense that the herds were purified. It cost Missouri $1,000,000, and Kentucky over $2,000,000. The disease still prevails in England and Scotland, to such an extent that importations from the latter country are now prohibited. Every encouragement possible should be given those who have the work in charge, that we may never be affected by it.

We have in years past and are still much interested in the scientific researches of Dr. Vaughan, of Ann Arbor, to ascertain the true cause of cheese poison. After hundreds of years of searching by learned and scientifie men, it seems to have been reserved for Dr. Vaughan to arrive at the facts. He first succeeded in extracting the poison, and named it "Tyrotoxicon." He laid down a rule by which its presence in cheese could be detected. He pronounced it caused by decomposition in some form, and during the year just passed he has without much doubt succeeded in tracing the formation to a true origin. The cases of ice cream and milk poisoning, which have come under his observation the past season, have made it quite plain that the difficulty develops in the milk, by foul odors arising from decomposed and putrid matter, where there is little or no ventilation. The ice cream that was made and kept in an unclean back hovel was filled with the deadly poison, and the same poison was produced in new and pure milk in a short space of time by placing in it some of the earth that lay under the floor where no ventilation was given. The same was the result in the case of the poisoned milk that was kept in a close back cellar where the loose bare floor lay close to the damp ground with the sweepings and wet of occasional moppings, had laid undisturbed, in almost darkness, for many years. A very small quantity of that earth also produced the tyrotoxicon in liberal quantities. Dairymen can take heed from this, and

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I believe entirely prevent the difficulties which have in the past caused so much anxiety. It has been well known for some years that a can of new milk will become "tainted" in a short space of time, if the can cover be allowed to remain on the can. That same milk would develop "tyrotoxicon" if allowed to stand in the can a sufficient length of time. A can of milk should always have a clean, open, airy place in which to cool, and never allowed to be within reach of any decaying substances. Milk should always be cooled thoroughly before the can cover is put on, to go to the factory. Keep all utensils thoroughly cleaned, and I believe we need not fear "tyrotoxicon." After everything else has been considered, one of the most important subjects for dairymen, at the present time, is how to keep the cows in condition for profitable service, at least expense. We frequently hear the remark that it costs too much to keep my cows. My cows have eaten more value in hay than they will make me in a year, etc. The solution to this is, do not feed much hay, it is too expensive, from the existing market rates that it would always command. It takes too much ground to feed a cow. The crop is very uncertain. We must always feed six months out of a year, and sometimes seven or eight; hence the importance of the question. I think our average dairymen use about five acres of land to keep a cow one year. Proof is in easy reach that three, two, and even one acre of good land can be made to grow all the grain and forage a cow can eat in 365 days. The one, two or three acres will be required according to the present condition of the land, and the degree of intelligence and energy there is in the man at the helm. The men who meet with the best results should be consulted. Examine their methods, their rotation of crops, their silos and their methods of cultivation and feeding. For us I am a thorough convert to drill corn as the cheapest and most economical forage and grain a dairyman can feed. It needs strong land, good cultivation and good judgment in harvesting. Every man who milks ten cows should have at least ten acres of this feed. Have less meadow land. It can be planted so late in the season that meadows are known to be a failure. On this line of cheaper food, take extra good care of the cornstalks, stack the wheat straw nicely, to throw out through the day in the back yard. Try and have the oat straw clean and bright, and put in the barn if possible. These points are all well worth your consideration.

I have thus sketched over the field of matters that suggested themselves as being of importance to the dairymen of Michigan, and I sincerely hope that your councils will result in giving new light and a general benefit to all farmers and citizens everywhere.

ENSILAGE FOR DAIRY USE.

[BY PROF. SAMUEL JOHNSON.]

The Legislature of 1881 made a special appropriation of $1,000 "for the purpose of conducting experiments with ensilage for the feeding of animals, by the farm department of the Agricultural College." To. Hon. J. S. Estabrook, of Saginaw, and Hon. Thos. Mars, of Berrien, chairman of the House and Senate committees on the College, the credit is largely due of securing this appropriation, which makes it possible for us to give this new method of preserving fodder crops some attention—especially at that stage in its history, when it had very few advocates among agricultural teachers or writers, and when a majority of farmers were inclined to think it one of the

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most visionary and foolish suggestions ever made in the name of agricultural progress.

A small silo was built in the basement of a grain barn then in process of erection, so that it might be utilized as a root cellar, if the ensilage should prove a failure. This was filled with corn in the fall of 1881, and careful feeding experiments the following winter demonstrated conclusively, to my mind, that the silo was to prove a very valuable auxiliary to the methods in vogue for preserving fodders for winter supply.

So far as I am aware, this was the first silo in Michigan. It has been filled five times, and every succeeding season has more fully confirmed my faith in its merits. We have fed ensilage with satisfactory results to young cattle, dry breeding cows, fattening cattle and milch cows, as well as sheep. It gives the succulent food which is so much relished by our stock during the long confinement of winter feeding. It is a cheap substitute for the roots upon which so many of our farmers rely, and can be handled and fed at much less expense to the general farmer.

The following table will indicate the number of pounds fed alone and in combination ration to cattle of different ages and the results of such feeding in the production of flesh and milk:

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TABLE *Showing by Fortnights the Results of the Feeding Experiment.*

Description of Animals.				Feed Record.								Weights and Gains.					Milk Yield.		
				Average Daily Ration.															
Number of Lot.	Number of Animal.	Name, Breed, Sex, Age, Etc., of Animals.	No. of Fortnight.	Meal.	Cut Hay.	Cut Corn Stalks.	Cut Oat Straw.	Sliced Rutabagas.	Ensilage.	Full Ration.	Total Feed Consumed.	Weight at beginning of Fortnight.	Weight at end of Fortnight.	Gain in Weight.	Gain Per Cent of Live Weight.	Gain Per Cent of Feed Consumed.	Total No. of Pounds.	No. of Pounds Shrinkage.	Daily Average.
LOT I.	1	Lulu of Lansing. Ayrshire milch cow. Age 3 yrs. Dropped first calf Sept. 2, 1881.	1	7.	-----	30.	-----	15	-----	52.	728	926	952	26	2.8	3.6	228.5	9.5	16.32
			2	7.	-----	-----	-----	----	49.	56.	784	952	916	-36	----	----	218.5	10.	15.61
			3	7.	-----	-----	-----	----	50.	57.	798	916	930	14	1.5	1.8	206.5	12.	14.75
			4	7.	-----	-----	-----	----	65.	72.	1,008	930	957	27	2.9	2.7	192.	14.5	13.71
			5	7.	-----	-----	-----	----	65.7	72.5	1,015	957	960	3	.3	.3	201.	*9.	14.36
			6	7.	-----	----	-----	----	63.7	70.7	990	960	976	16	1.7	1.6	191.	10.	13.64
	2	Hermia 2d. Shorthorn milch cow. Age 3 5-12 years. Dropped first calf Sept. 3, 1881.	1	7.	-----	32.	-----	15	-----	52.	728	1,284	1,212	-22	----	----	193.	1.	13.79
			2	7.	-----	-----	-----	----	59.	66.	924	1,212	1,185	-27	----	----	188.	5.	13.43
			3	7.	-----	-----	-----	----	60.	67.	938	1,185	1,236	51	4.3	5.4	172.5	15.5	12.32
			4	7.	-----	-----	-----	----	66.5	73.5	1,029	1,236	1,244	8	.6	.8	164.5	8.	11.75
			5	7.	-----	-----	-----	----	62.	69.	966	1,244	1,268	24	1.9	2.5	172.	*7.5	11.29
			6	7.	-----	-----	-----	----	62.	69.	966	1,268	1,264	-4	----	----	166.	6.	11.86
LOT II.	3	Batavia 2d. Devon steer. Age 1⅝ years.	1	5.	5.75	9.	-----	----	-----	19.75	277	740	710	-30	----	----			
			2	4.5	6.5	-----	-----	----	21.5	32.5	455	710	760	50	7.	11.			
			3	5.	7.5	-----	-----	----	26.21	38.71	542	760	778	18	2.4	3.3			
			4	-----	-----	-----	-----	----	36.25	36.25	508	778	776	-2	----	----			
			5	-----	-----	-----	-----	----	41.82	41.82	585	776	760	-16	----	----			
			6	-----	-----	-----	-----	----	39.25	39.25	550	760	746	-14	----	----			
	4	Scott. Ayrshire steer. Age 1⅝ years.	1	5.	5.75	9.	-----	----	-----	19.75	277	680	700	20	2.9	7.2			
			2	4.5	6.25	-----	-----	----	19.	29.75	417	700	736	36	5.1	8.6			
			3	5.	7.21	-----	-----	----	23.14	35.39	495	736	756	20	2.7	4.			
			4	3.	-----	-----	-----	----	37.29	40.29	564	756	767	11	1.5	1.9			
			5	3.	-----	-----	-----	----	44.82	47.82	669	767	774	7	.9	1.			
			6	3.	-----	-----	-----	----	44.43	47.82	669	774	780	6	.8	.9			
LOT III.	5	Bonny Red Rose 2d Shorthorn dry cow. Age 7 1-12 years. 4 months with calf.	1	3.5	7.5	11.5	9.5	15	-----	47.	658	1,516	1,530	14	.9	2.1			
			2	3.25	6.25	9.5	8.5	----	15.	42.5	595	1,530	1,552	22	1.4	3.6			
			3	3.5	7.5	8.86	8.92	----	15.	43.78	613	1,552	1,570	18	1.2	2.9			
			4	3.5	-----	-----	-----	----	73.43	76.93	1,077	1,570	1,594	24	1.5	2.2			
			5	3.5	-----	-----	-----	----	84.18	87.68	1,228	1,594	1,630	36	2.3	2.9			
			6	3.5	-----	-----	-----	----	78.50	82.	1,148	1,630	1,636	6	.4	.5			
	6	Crystal Queen 9th Shorthorn dry cow. Age 5 5-12 years. 5 months with calf.	1	3.5	7.5	10.5	11.5	15	-----	48.	462	1,492	1,530	38	2.5	8.2			
			2	3.25	6.25	9.5	10.	----	13.5	42.5	595	1,530	1,536	6	.4	1.			
			3	3.5	7.5	8.42	9.28	----	15.	43.7	612	1,536	1,594	58	3.8	9.5			
			4	3.5	27.75	-----	-----	----	-----	31.25	438	1,594	1,605	11	.7	2.5			
			5	3.5	24.78	-----	-----	--	-----	28.28	396	1,605	1,630	25	1.6	6.3			
			6	3.5	23.25	-----	-----	----	-----	26.75	375	1,630	1,646	16	1.	4.3			
LOT IV.	7	Helianthus. Shorthorn bull calf. Age 1 year.	1	5.5	12.5	-----	-----	13	-----	31.	434	598	650	52	8.7	12.			
			2	5.63	6.38	-----	-----	----	23.	35.01	490	650	678	28	4.3	5.7			
			3	5.28	6.78	-----	-----	----	27.57	39.63	555	678	726	48	7.1	8.7			
			4	5.	6.5	-----	-----	----	29.42	40.92	573	726	758	32	4.4	5.6			
			5	5.	6.39	-----	-----	----	29.96	41.35	579	758	802	44	5.8	7.6			
			6	5.79	7.29	-----	-----	----	30.	43.08	603	802	848	46	5.7	7.6			
	8	Horatio. Shorth'n bull calf. Age 11-12 years.	1	5.5	9.	-----	-----	14.5	-----	29.	406	508	540	32	6.3	7.9			
			2	5.63	5.	-----	-----	----	24.50	35.13	493	540	568	28	5.2	5.7			
			3	6.	3.78	-----	-----	----	27.50	37.28	522	568	616	48	8.5	9.2			
			4	6.	3.82	-----	-----	----	28.92	38.74	542	616	650	34	5.5	6.3			
			5	6.	4.79	-----	-----	----	29.82	40.61	569	650	688	38	5.8	6.7			
			6	6.	5.36	-----	-----	----	29.79	41.15	576	688	720	32	4.7	5.6			
	9	Hamlet. Shorth'n bull calf. Age 9-12 years.	1	5.5	8.13	-----	-----	14.5	-----	28.13	394	490	528	38	7.8	9.6			
			2	5.63	4.	-----	-----	----	24.50	34.13	478	528	560	32	6.1	6.7			
			3	6.	3.5	-----	-----	----	27.35	36.85	516	560	600	40	7.1	7.8			
			4	6.	3.32	-----	-----	----	29.50	38.82	543	600	631	31	5.2	5.7			
			5	6.	3.46	-----	-----	----	29.75	39.21	549	631	676	45	7.1	8.2			
			6	6.	4.39	-----	-----	----	29.82	40.21	563	676	708	32	4.7	5.7			

*Gain.

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After these repeated trials in the feeding of the ensilage and noting the great advantages of this method of preserving forage crops—among which may be named the growing per acre of corn equivalent in feeding value when placed in the form of good ensilage, of from six to eight tons of good hay; economy and storage; ease and convenience of feeding; healthy condition of animals fed largely on this food—all these were considerations that led me without hesitation to recommend to the State Board of Agriculture last spring the erection of a new silo of 150 tons capacity. The recommendation was adopted, and I was authorized to let the contract for the entire work on the most advantageous terms.

The following description of the new silo and the time and manner of filling, temperature, etc., will be of interest to those who are thinking of adopting this system:

The dimensions of the new silo built at the College last summer are 18x30, with a partition in the center, making two silos each 15x18 outside measurement, and with a total capacity of 150 tons. The silo is located on the north side of our cattle barn, which has a basement stable. We excavated some six feet to have the silo floor on the same level as the stable floor. The excavation is walled up to the surface with stone laid in ordinary mortar—a good 18-inch wall. Doors open from each silo into the feeding room, adjacent to the stable and on the same level. On this wall sills made of plank are bolted, and joists 1x12 and 16 feet long are used for studding and placed one foot apart. On the outside ordinary stock boards battened and painted with two coats made the finish. On the inside the studding was first covered with shipping culls, put on horizontally. On these a layer of tarred paper, then a second covering of boards was put on perpendicularly. This was lathed and plastered with water lime cement. The floor is just as left when the excavation was finished. A good shingle roof, with a window and outside door in each silo—the latter for putting in and taking out the materials for weighting—completes the building. The ensilage would have kept just as well without the cement coat. We put that on to preserve the boards. Kept constantly wet, they will soon decay where the ensilage is placed next to them. The cost of the silo was $430. As a hay barn it would hold eighteen tons. This silo has a capacity equivalent in feeding value to fifty tons of hay.

We began filling this silo Tuesday, September 6, filling one day in one—the next day in the other. The 11th being Sunday, no work was done. From Monday, 12th, until Saturday we continued the filling, usually working the afternoon of each day, as we could then have the students to assist in the work. It will be seen that the filling extended over a period of eleven days. The silo was not weighted until Monday, the 19th. The temperature of the ensilage, after standing thirty-six hours, was 108 degrees. It is claimed that when some thirty-six hours intervene between the filling, the temperature will reach 130 to 135 degrees and that in this temperature the germs that cause the decomposition will be killed and the ensilage will be sweet. Our ensilage is very good, I think as good a sample as I have ever seen, and quite sweet; but the temperature never exceeded 108 degrees, as carefully taken by my assistant.

The corn was run through a Bell City feed cutter, cut three-quarter inches long, and elevated by a carrier into the silo, where it was thoroughly packed by the treading of three or four men constantly. One hundred and four tons

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of ensilage and field corn were put in the two silos, making about fourteen feet depth of ensilage. After weighting and settling it measured twelve feet, only settling two feet. A cubic foot from two feet below the surface weighed 36 pounds, eight feet below 48 pounds, ten feet down 50 pounds.

I am not prepared to advise no weighting of the silo, as some writers are doing. I think those who have had the most experience with silos still adhere to the weights. Not as much may be needed as we thought necessary in the beginning of silo building, but the extra outlay required to weight is too trifling to warrant our taking the chance of a failure, because of neglect in this particular. Prof. Alvord, after some years of experience, in a recent address before the Massachusetts Board of Agriculture, favored heavy weighting.

After three years of practical tests, I do not hesitate to recommend the silo to dairymen as an economical method of furnishing a large share of the winter food for young cows. One year's experience with a good silo, properly filled, will convert every doubting Thomas among you to the merits of this method of preserving fodder.

Ensilage should never be the only food of the animal, but fed in connection with some grain and dried fodder to secure the best results. It has passed the trial period and has come to stay. Silos have been built all over the country, and without exception, so far as I can learn, when a silo has been filled properly and its contents fed judiciously by a practical cattle man, it has proved satisfactory. Some visionary people who have seemed to think that ensilage was to revolutionize cattle feeding and that it would supplement the lack of care and common sense in feeding and management, have, as a matter of course, been disappointed, and a few of our farm journals have taken special pains to call the attention of the public to these examples of failure.

Query: Is it because the papers or their contributors took the wrong side of this question on the start, and have been trying to prove themselves consistent ever since, that they maintain this antagonism?

The English Parliament recently appointed a committee to investigate and report upon this method of preserving fodder as likely to be of great importance to agricultural interests. The committee, composed of some of the best-known men in the kingdom, after taking a large amount of evidence from those who had built silos and fed ensilage, and after the most thorough examination of the subject, have made a most favorable report. They say that "all the evidence seems to show that a nourishing, useful food for animals can be preserved by this process." They further report "that the testimony of the dairy farmers does not justify the assertion that dairy products are injuriously affected by ensilage, but that, on the contrary, it distinctly improves the yield of milk and cream and the quality of the butter—the silos in Great Britain have doubled in numbers in the last twelve months—and that the evidence warrants the extension and development of the system as a valuable auxiliary to the farm."

The following letter to the *Mark Lane Express* from a Mr. Blunt, of Leicester, England, will be of interest, as containing a scientific test of the milk product of ensilage-fed cows:

"A notice issued by the manager of the Anglo-Swiss Condensed Milk Co., saying that he would not use milk from ensilage-fed cows, has caused some amount of anxiety to those who, like myself, have succeeded in making ensilage and find in it a most valuable addition to our food supply for dairy cows. Allow me to say that in conse-

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quence of such notice, I requested Dr. Emmerson, the public analyst for the counties of Leicester, Northampton and Rutland, to analyze the milk of those cows which I had fed entirely upon ensilage for several weeks. The following is his report:

"'The sample is of specific gravity 1034, and consists of the following percentages: Total solids, 13.120; fat, 3.300; solids not fat, 9.820; ash, 0.830; water, 86.880. These results represent a milk of first-rate quality, and prove that the food was nutritious, and that the cows had been in good health, so as to enable the mammary glands to secrete a milk so rich in albumen, fat, etc. The microscopic examination showed the usual abundant small oil globules, and absence of pus cells or any foreign matter.'

"In a letter accompanying his report, Dr. Emmerson says: 'The only possible objection to silos can be when they are imperfectly constructed, so as to allow more air to reach the inclosed vegetable matter than admits of oxygenation beyond a certain amount, and decomposition begins; then, of course, the food would be unwholesome.'"

In conclusion, I hope none of you will get the impression that the silo is impracticable or that it is a fine-spun theory that amounts to nothing. There is not one of you, who is a practical farmer, but that if you built a silo and filled it with ensilage one year, would be pleased with it. Don't expect it is coming in of itself and going out of itself; but, with proper work, you will find it is one of the foods you can use to advantage and profit.

E. N. Bates: I would like to ask if the cattle show any preference for the warm water?

Prof. Johnson: The evidence is in the fact that they drink more, and drink it eagerly. In cold water they dip their noses but don't like it.

Question: Do you know the difference in the temperature that was called "cold" and "warm?"

Prof. Johnson: The "cold" was taken out of a tank where there was ice. The "warm" was 60° Fahrenheit.

Mr. Moore: A silo should be as nearly air-tight as possible, either of wood, stone or brick. I built a silo a year ago last summer. I used an old bay in the barn, 16x32 feet, about 14 feet deep, at the sides. I double-boarded it and put paper between the boards, making it as near air-tight as I could. I filled with clover—I think clover is the best for ensilage, and after filling, covered with boards and papers, weighing down with brick. When the cattle commenced to eat it they didn't like it, but after a while they liked it very much. I fed fifty head of cattle and about twenty head of horses, from the middle of December to the 3d of April, two feeds on ensilage and one on hay. It seems to me as though the ensilage we fed did more good than three or four times as much hay. Twelve acres of clover, put in a silo, make more feed than twelve acres of hay, and is better for cows.

This year I have a different experience to relate; I filled just as I did last year, but was governed in finishing by an article I had read about leaving it without weight. As I was busy, I though it was a nice thing to get rid of any work, so simply covered my ensilage with two or three loads of hay, and then a few days later put some marsh hay on top; and when I opened the ensilage I found we had lost a large portion.

Peter Coller: Which would be cheaper and easier done, to make the ensilage as you did or to put it in in a dry state, if the weather was good?

Mr. Moore: If the weather was perfect, you might possibly cure your hay as cheaply; but taking one kind of weather with another, it is cheaper in the way of ensilage. Another thing, you can get so much more in the same space. I put in forty-two loads, where I used to have sixteen.

Question: Did you cut before the dew was off, or wait until after?

Mr. Moore: I waited until the dew was off, and I would prefer not to cut during a storm. The less water the better.

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Question: Was it in full bloom when you cut it?

Mr. Moore: The most of the ensilage that has been put up heretofore has been too green. You want it well matured. It can be quite a good deal riper than hay and make good ensilage. Corn makes better ensilage when ready to glaze.

John Boyd: I built a silo last fall and filled it with corn. I had no trouble in keeping my ensilage, with the exception of about two inches, and without weighting. I simply covered the top with boards and then put a layer of paper, and then crossed other boards in the opposite direction. I think I am feeding this winter at one half the cost of former years. From ten acres of corn, well grown, on rich soil, I put in 185 tons of ensilage, in a building 20x32. I consider it a grand, good thing, and a farmer could do nothing that would pay him better.

E. D. Dickinson: In feeding hay there is quite a large percentage refused by the stock. Is it all eaten when fed as ensilage?

Mr. Moore: In my case, every part was eaten. I didn't put my ensilage in entirely for economy, but I found it difficult to raise roots and have a profitable crop, and I felt that my stock needed something of that nature to keep them in good condition. It is one of the cheapest foods there is.

Mr. Garner: How long will a board silo last? Wouldn't it be better to build of stone?

Mr. Moore: Stone doesn't answer the purpose as well as wood. You require a certain amount of heat. It took me three or four weeks to fill mine; and the lower we get down the finer and greener it is, almost as green as when we put it in; but we did not fill every day; we filled three or four feet and then stopped until the heat raised to 130 degrees. The effect is to kill the germ and create fermentation. In a stone building, I don't know whether it is dampness or coldness, but a large quantity injures next to the wall. A wooden building costs less, and you can afford to rebuild it in half a dozen years, but it will last longer if painted with linseed oil or petroleum.

F. I. Kinney: I would like to ask if giving the cow this feed makes as good milk and butter as the old-fashioned way?

Mr. Boyd: I found the taste in the butter quite marked, and it took me a long time to find out that it was from feeding the ensilage just before I milked. We fed the ensilage after milking and we had no trouble. As to the value of the feed, I would say my cows never made as much butter as they have this winter. I am making twenty-five pounds of butter a day from fourteen cows. The cream is rich and the butter is fine, bringing the highest price in the market.

Mr. Moore: I would like to ask Mr. Boyd if he thinks the bad flavor was caused by feeding before, or whether in feeding the ensilage before he milked that the odor of the ensilage was absorbed by the milk and caused the bad flavor of the milk, or, rather, the butter?

Mr. Boyd: No, sir; it came from the cow's stomach.

R. Lespinasse: I would like to ask Mr. Moore if he has ever had any experience with what we term "sweet and sour ensilage?"

Mr. Moore: There was a little of that ensilage that was almost dry enough for hay, and when that came out it hadn't moulded a particle, and didn't have such an acid smell as the other. It was sweeter than the other.

R. Lespinasse: Will Mr. Moore tell us the character of the decomposition that took place when he used no weight?

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Mr. Moore: It was a moldy, light color, as you see on manure. I put it into the yard and the colt ate a good deal of it.

R. Lespinasse: How about feeding horses and fat stock?

Mr. Moore: It did nicely.

W. H. Strong, Ohio: I built a silo last year and filled it with corn, and I had the experience of this gentleman. The first part of the ensilage that we put in, we hurried with. It only heated up to about 80 degrees, and after we had filled about six or eight feet it got up to 130, and, when we fed it out, we could see the lines of the heat in the sweetness of the ensilage. The ensilage of the proper heat is sweet, and the other is sour and the cattle don't like it. I see no injury to the milk.

Mr. Boyd: Do you feed before you milk, or milk before you feed?

Mr. Strong: We feed before we milk.

Question: Feed and milk immediately?

Answer: Yes, sir.

Mr. Strong: We have discovered no taint in milk or butter. I have showed it to competent judges, and they pronounced it good butter. We don't leave the milk in the stall long. We carry it right out.

Question: What stage of maturity was your corn in?

Mr. Strong: Mine was the Southern white corn, and when I cut it I saved some seed. It was pretty dry—I thought too dry, as it went into the silo. Mine is a wooden one, and lathed and plastered with water lime cement.

Peter Coller: I would like to hear Mr. Strong state about his filling his silo, if he had such good ensilage, whether he filled it right along or waited several days.

Mr. Strong: We were twelve days in filling our silo. It is sixteen feet wide and forty-two feet long, in three pits, two partitions, and we were twelve days filling. That is, without counting Sundays. At first we put it in too rapidly and did not give it time to heat; but after it had commenced to heat, we couldn't any more than keep ahead of it. But you should always stop one or two days after the first filling.

Mr. Bush: We have noted about the construction of the sides. I would like to hear of the bottom.

Mr. Strong: Simply the earth constitutes the bottom, with a little straw thrown over it, and the surface drainage is sufficient for it.

S. M. Hamilton: Is it essential that it should be cut, or can it be put in whole?

Mr. Moore: I knew a man who practiced putting it in whole, and he had very good results from it; but I saw him last week, and he said he always cut it up now; and had made ensilage for a good many years. Then you can get so much more in the same space that I think it is desirable to cut it up.

Mr. Strong: Some one asks how much I put in? Well, I filled it two-thirds full with the crop from nine acres. The pit was twenty feet deep. As near as I can estimate, raising the corn and putting it in, costs me two and one-half cents per day for each cow, two feeds a day. I never weighed it, but, as near as I can estimate, it will take one and one-quarter cubic feet of ensilage per day a cow. I also feed corn-stalks, with grain, to those that are giving milk.

Q. Tappan: Did you ever know of ensilage cooling off? Is it always hot?

Mr. Strong: In the pit you mean? Not until you get to the bottom. It never is very cool. It never froze when we didn't disturb it; but if you loosen it, it will freeze. It is warm enough to keep out the frost.

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Mr. Tappan: I put in a silo last fall. I put in corn, and was four weeks filling it. We would fill about two or three feet every afternoon or every alternate afternoon, spreading it around and treading it down well; but before we got through the corn got dry, and the man that is running my farm claims that the first was the best, and he says another year he will commence just as quick as there is sufficient growth. I built it of boards and lumber. I run a dairy of thirty cows, and I never saw cows do better than they have done this winter. My silo is twenty-two feet high.

Question: Do you run a city trade?

Mr. Tappan: Yes, sir; we run a city trade and give good satisfaction. I think, from all I can learn, that a silo should not be filled in as short a time as a great many people claim. We put on a double cover and a paper lining all around the edges to keep it air-tight, and it has kept without any trouble. I feed corn-stalks and ensilage mixed.

Mr. Strong: In feeding ensilage cattle do not drink as much water. Sometimes they won't drink at all. The warmth of the water is not of much importance in my estimation.

Mr. Lespinasse: I beg to differ with the gentleman from Ohio, who has the idea that the water question makes but little difference, for we have against that the actual experience of men who had the conditions—such conditions as we rarely meet with—of warm stable, good care and attention, cleanliness, good ensilage, feed and every other condition that you can suggest, toward perfection—and with these conditions they have practiced this theory—practiced it from day to day, and found it to be of great value. I can tell you of a man who was not satisfied with warm water and went to work to heat his stable, and he said, with the same stock, with the same conditions of animal life, with one-half the feed he used the winter before, he produced the same quality and quantity of milk.

Mr. Boyd: I have warmed the water for my cattle for the last five years, but I notice that when they eat ensilage they drink less water; but they require warm water just the same. I have a fire in the tank, and heat it to 90 degrees every day. If you have warm water and cold, they will take the warm, but it is not so much the temperature as the quantity they drink. Milk is 85 per cent water. If you drive cows out and give them water at 80 degrees, they will drink a pail of it. At 32 degrees, they will not drink at all. I would heat my water, and you can do it at a small expense—five cents a day.

Mr. Wilson: I would like to ask Mr. Moore what is the reason they can't raise roots in St. Clair county.

Mr. Moore: I don't know why it is we cannot raise them as well as you can in other parts of Michigan, but I think they can only be raised successfully in a climate like England.

Mr. Baker: I have had a little experience in raising roots, and we still continue to raise them. We raised 2,350 bushels, and thought it a profitable crop.

President Horton: I have heard that ensilage takes the place of roots and is much cheaper. I would like to ask Mr. Boyd's opinion.

Mr. Boyd: I would say that the ensilage is as four to one against the roots and in favor of the ensilage.

Mr. Baker: I am sorry that I have not had any experience in raising ensilage. This gentleman talks of roots costing a great deal. We had two

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young men see how fast they could cut them, and they cut ten bushels of roots in four minutes, easily.

Mr. Boyd: After they are in, there is more or less dirt on them; and if you carry enough to feed forty head of cattle, your arms will ache.

Mr. Baker: They carry them on wheels.

Mr. Lockwood: I consider this dirt upon them a grievous trouble. I couldn't rid the roots of the dirt.

Mr. Strong: There is another thing in this root question, and that is, toward spring they will decay in spots; and if you feed those you will see a bad result in the milk.

Mr. Tappan: No roots for me, if I can get good ensilage. I want to ask Mr. Boyd about the apparatus for heating water at five cents a day.

Mr. Boyd: It is a simple apparatus. There is a cylinder in the water tank, my tank is twelve feet in diameter, and the fire is right in the cylinder, either wood or coal. There is no danger of fire, as the water surrounds the cylinder at all times. The first one I made of galvanized iron, but the trouble was, if the water didn't cover the cylinder it would burn out. I now have one made of cast iron and it will not burn out, even if the water doesn't cover it. And here is the economy in heating the water. I have no doubt, but it adds twenty-five per cent. to the flow of the milk, over and above ice-water.

Mr. Moore: The question is, how much the heat of the water adds to the quantity of the milk, and this question people have not tested carefully enough. I never weighed any milk, but one of my neighbors has done so, and he told me there was a little difference in favor of warm water, but he didn't think that there was enough difference to pay him for the extra trouble that he went to in heating the water. He said he found from weighing the milk that he got about one pound a day more from each cow with warm water than cold water.

F. E. Pickett: About what quantity does it take to feed a cow through the winter?

Mr. Lespinasse: Using ensilage for feed, the ration was from thirty-two pounds up to sixty-five. In regard to the warm water question and the expense of an apparatus, you can get a good one at a cost not to exceed $3.75.

MAKING BUTTER FROM FORTY COWS.

[BY MRS. E. L. LOCKWOOD OF PETERSBURG.]

[Read at the Adrian meeting of the Michigan Dairymen's Association, February 15th, 1888.]

[Mrs. Lockwood is not connected with the Agricultural College, but I take the liberty of reprinting a part of her article.—EDITOR.]

* * * *

How well I remember, twelve or fifteen years ago, when we were struggling along in the old way with our dairy of twenty cows, straining the milk into small pans and setting them on the racks (for we had already learned that they were preferable to shelves); and, when the time for skimming came, slowly and laboriously taking each one down, setting it upon the table, removing the cream with the little old fashioned skimmer, lifting each pan again and pouring out its contents. Then came the washing and scalding, wiping and sunning of sometimes as many as seventy pans, on sultry mornings and on washing days, then the churning in the old dash churn, the working the butter with the hand ladle, lifting the whole mass to drain off the

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accumulated moisture. What wonder that, under such circumstances, one poor, discouraged soul asked to have carved on her tombstone, "Died of Butter and Cheese?" The only strange thing is that they did not all succumb to the same verdict. Just as this danger was becoming imminent in my own case, a good angel, in the person of a relative from Vermont, herself a dairy woman of large experience, dropped down upon us, and she said: "Why do you slave so? You can halve your work and double your profits with better conveniences." This was an enticing suggestion, surely. And then she told us of the then comparatively new process of setting in large open pans, each holding an entire milking, known as the Hyde coolers, manufactured at Cortland, N. Y., and which were just coming into use in the Eastern States. I was ready to try almost anything, for the situation was getting desperate, and soon the sound of the hammer and chisel was heard in our land, and, presto! a milk room of goodly proportions arose, in comfortable proximity to the kitchen but entirely distinct from it. Then our pans arrived—four in number, each holding 100 gallons (the size for a dairy of fifty cows), each pan standing upon a table of the same size, 8½x3½ feet and having a double bottom, through which cold or hot water could circulate, thus regulating the temperature according to the season. Each pan was connected, by means of a rubber plug at one corner, with a pipe which conveyed the skimmed milk into a receptacle outside the room. The men, as they brought in the milk, poured it into a strainer connected with the pans. No lifting or carrying away; and, when I took the large, easy skimmer, in shape something like a perforated dust-pan, and walked around the pans, removing the cream from 100 gallons as quickly and easily as we could from a dozen small pans, removed the cork and watched the milk flowing away, with no effort on our part, then poured in water quickly and washed and dried them—when I had done this and noted the increased amount and better quality of the cream obtained, I drew a sigh of relief and began to rest and, metaphorically speaking, have been resting ever since.

The process decribed may not be the best now known. Great progress has been made in the past fifteen years, but that it is immeasurably superior to the old process, I know. On a recent visit to Addison County, Vermont, where almost every farmer keeps a dairy (it is the leading business of the country), I found them still using the cooler; indeed, it was a surprise not to find a single instance of a dairy run on the submerged plan so common in use here. The public creameries that I visited used the centrifugal separator. I believe this to be the coming method; and when some benefactor of his race shall have simplified the arrangement, thereby reducing the cost so as to bring it within the means of the average dairyman, then the dairy millennium will begin to dawn. Speed the day.

The barrel churn is, undoubtedly, the best now known. I am using one with a capacity of sixty gallons, and find it very satisfactory. They should never be filled more than half-full—a little less is preferable. With the cream at the proper temperature, which can be easily ascertained by a dairy thermometer (about 57 degrees in summer and a little higher, say 60 to 62 degrees in winter), it should never take more than a half-hour to bring the butter. When it arrives at the granular stage, a pailful of weak brine is dashed into the churn, which is then gently agitated for a moment, to allow it to become thoroughly incorporated; then the churn is allowed to stand a few minutes—five are sufficient—when the buttermilk will flow off clear.

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The butter is then washed through two waters by pouring in the water and gently agitating as before and drawing off. It is now ready for the salt, which is sprinkled on at the rate of about one ounce to the pound, varying a little according to the kind used, as we all know there is quite a difference in the strength of the different brands—the Ashton, for instance, being much stronger than the Michigan Dairy. After the salt is added, the lid is replaced and the churn revolved until it is thoroughly mixed and the butter gathers. It is then removed and allowed to stand for a few hours for the salt to dissolve. Next it is run through the level butter worker and the brine gently pressed out. Then it is packed in gallon and half-gallon jars, stamped with our name (to which we intend to add the coming season, day and date of making), covered with oiled paper, tied over with another paper, and it is ready for market. And he who can look upon these jars of golden nectar and feel no pride in the work of his hands has mistaken his calling.

TICKS.

[BY PROF. A. J. COOK, OF THE AGRICULTURAL COLLEGE.]

[Read February 16, 1888, at the Adrian meeting of the Michigan Dairymen's Association.]

The word "tick" is used in common parlance to designate two very different groups of animals; thus we speak of sheep ticks and horse ticks. These are curious insects of the order *Diptera*, the same that includes our house flies, mosquitoes, meat flies, etc. They are degraded members of the order, as seen in the wingless condition of the sheep tick. Were we to place wings on these sheep ticks we would have a fair representation of bird ticks, often found on owls and other birds. The forest fly or horse tick also has wings.

All these ticks are curious in their development. Usually, insects lay eggs. These hatch into worm-like forms known as larvæ. You are familiar with these in maggots, grubs and caterpillars. From their form, they are often, although incorrectly, called worms. When full-grown—for all growth in the insect is during the larva state—the larva changes to a pupa, when it is apparently lifeless, and at which time it eats nothing and does not move. Soon comes the imago or perfect insect—it were better to say mature insect—when the wings are present and the insect prepares to perpetuate its species by mating and egg laying.

As just suggested, the sheep ticks and their close allies are quite exceptional in their development and strongly remind us of the higher animals. Here the eggs hatch within the mother tick. The larvæ exist in a sort of uterine sack, where a nutritious, milk-like substance is secreted. Here the larvæ absorb their nourishment, complete their growth and change to egg-shaped pupæ. These are covered with an adhesive slime, and when deposited by the tick, readily adhere to the wool. You have noticed these brown, egg-like bodies and, no doubt, supposed they were eggs. Soon the pupa changes to the mature tick, which is armed with a sort of force pump for mouth organs, and with this it sucks the poor sheep's blood.

Of course, I hardly need say that by dipping sheep in a strong decoction of tobacco water they are quickly freed of these enervating ticks. The treatment does no harm to the sheep if they are kept from being chilled. (Let me add that this is a tip-top use to which to put tobacco. We may rejoice when little bugs are killed by tobacco—but it is not pleasant to see how generally the same weed is used to kill "big bugs.")

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The other group of animals to which the name tick is applied, and the one in which I am specially interested to-day, is quite widely separated from the forms just considered; in fact, these are not insects at all, but belong to the great sub-class of spiders. Thus, they have eight legs instead of six, have only simple eyes and are without the horn-like organs known as antennæ, familiar in all insects.

That you may have in mind the ticks to which I now refer, I will simply mention the old-time wood-tick, which, more commonly in former years when forests were the rule and not the exception, would often pre-empt a little space on your neck or back as you visited the woods for pleasure—or may be for the cows. Many of you will remember the stinging pain as one of these little freebooters (or, rather, free-suckers) inserted its rough force pump preparatory to sucking your life's blood. These ticks belong to the order of *mites, Acarina,* which are distinguished from others of the spider group in that the body is a mere rounded sack, to which legs and mouth organs are attached. Take a common grape, flatten it from above, append eight legs and a sucking beak, and you have in form a mite. The mites when first hatched have only six legs, while all others of the sub-class, spiders, have four pairs from first to last.

Mites are so named because they are very small. Indeed, most mites are microscopic. Ticks, on the other hand, are often as large as, or larger than, a Delaware grape; hence, if our grape was of the Iona or Delaware variety and had a skin varying in color from a light bluish gray to dusky or brown and then had the legs and beak attached, it would represent a tick. Ticks, then, are gigantic mites.

The minute or microscopic mites touch man's interests in many directions and so are interesting to us all. Some of the mites infest poultry and other of our domestic animals and so are often a serious obstacle to the health and vigor of our pets of the farm-yard. An ointment of sulphur and kerosene (and even lard and kerosene if wisely used) will soon banish these pests from the poultry-yard or dog-kennel.

Birds often harbor mites in prodigious numbers. If they build nests on the house porch or about the windows, mites will often be seen on the glass panes near by. I have often known ladies to be much annoyed at seeing their windows converted into a parade ground by such *Acarina.*

But the little pests do not stop here. The face mite is long and slender and burrows into the skin on the human face, preferring the nose, and forming pimples. It has been said that at least one person in every ten harbors these pimple mites. They are hard to exterminate, but, fortunately, they do little harm except to mar the fair face of beauty. Possibly they may do good in humbling pride, thus proving the truth of Shakespeare's paradoxical words, "Sweet are the uses of adversity." Mange in the lower animals is thought to be due to the same or a similar pest. A more repulsive but better known inhabitant of the human skin is the itch mite. This, probably for protection, seeks lodgment in the axils between the fingers of the hand. It is very small, but when seen with a good microscope it looks quite formidable and not a whit desirable. By use of its saw-like mouth organs it mines away in the skin, forming disgusting pustules, and as it rasps with its minute drills, it emits a poisonous liquid which causes the irritation; hence the name itch. Fortunately, this disease is now rare; but within a few months a young man came into my laboratory with a flourishing colony of

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these itch mites reveling in his tissues. A moment's work showed him, under the microscope, what was feeding upon his substance. He said that he had been suffering for years, and although he had been to several doctors none could give him relief. He was made happy by learning that a little mercurial ointment would speedily free him from this horrid plague. (It seems a sad comment upon the skill and erudition of our physicians that they could not diagnose correctly or treat successfully the itch plague; or, is it, rather a proud boast for our civilization that itch is so rare nowadays that the doctors have no opportunity to study it and little occasion to treat it?)

The cheese, sugar and flour mites are each named from the article they inhabit and feed upon. They are very small and usually escape notice. "Where ignorance is bliss 'tis folly to be wise." Occasionally a housewife is so keen of vision as to note the lively condition of her meal and sugar, and she is not usually pleased, for howsoever gratified the good housewife is to see her flour rise, she does not like to see it walking off.

The red mite, *alias* red spider, is well known as a serious pest of such plants as may become victims to its presence. It only thrives in a very dry atmosphere and so is quickly put to rout by moisture. This mite covers the foliage, which it infests, with a web. Many of you have seen the wart-like excrescences that so thickly cover the underside of such leaves as soft maple, sugar maple, linden, etc. These are caused by a long, very minute four-legged mite which dwells within and feeds upon these galls. I doubt if these are very harmful, as I know of trees whose leaves have been fairly covered with these galls for years and yet the trees seem healthy and vigorous.

But my special purpose at this time is to discuss the monster mites or the ticks. Very likely some of you wonder at this, for, very possibly, you, like myself, although familiar with ticks in your boyhood days, have not seen one for years. For my own part, I have not seen a living specimen of the old wood-tick for nearly twenty years, and only one for more than twenty-five years. A moose which I imported from Manitoba a year ago for our college museum was well covered with moose ticks, which were much like our old acquaintance and possibly, although not probably, the same species. The surname, so to speak, of these ticks is *Ixodes*. The one of which I wish especially to speak at this time I suppose to be *Ixodes bovis*. It is a large tick and is found in Missouri and in the South, and is very common in Texas, Mexico and Central America. I have a specimen five-eighths of an inch long and seven-eighths of an inch wide. The color varies from a light gray with a bluish tinge to a dark olive. Two yellowish lines at the anterior end, quite near together, run nearly parallel, although a little divergent for a short distance back, about one-third the length of the tick, when each line forks, the outer fork running out and back until it reaches the side margin of the back a little posterior to the middle of the tick. The inner forks approach each other for a little distance and then extend straight back. When viewed with a microscope these lines are seen to run zigzag. Two similar wavy lines are seen on the under side of the body. They extend from the posterior extremity, about midway on each side, forward for one-fourth the length of the body, then turn abruptly out for a little distance. The opening to the oviduct, which is quite central on the under side of the body, is also ringed by the same yellow color. The legs and mouth parts are brown. These immense ticks were imported into Van Buren county, in this State, near Paw Paw, on some Texan ponies which were brought up and sold at

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auction. As such sales are of common occurrence and apt to be inflicted upon any section, this matter is one of common interest. I received the ticks from Mr. J. C. Gould, of Paw Paw, and also the information, which I am glad to furnish you. The ticks were brought in great numbers on "Kansas ponies" from Texas. Farmers took the ponies to pasture, and in some cases they were placed in pastures with no other stock; but other stock was turned, in upon the removal of the ponies, and such stock soon became badly infested with the ticks. It is thus proved that infested stock will scatter the germs of this trouble and that other stock may contract the plague, although there may never be any actual contact of infested animals with them. In from four to eight weeks after cattle and horses were placed in these pastures they were literally covered with the terrible ticks. In some cases a silver dollar could not be placed upon a horse or cow without covering one or more ticks, while the more tender portions of the skin were crowded as thickly as could be with the tormenting things. Mr. Gould sent me ticks taken from within a horse's ear. The ear seemed entirely raw as far in as could be seen. There were at least 100 full grown and many immature ticks in each ear. The unfortunate beast had rubbed the hair off from much of its body. Horses looked spotted, as they would rub the ticks off, tearing their bodies off from their mouth organs, which latter were buried deeply in the horse's skin. The wound would fester, scab over, and be so deep that white hairs sometimes grew out when it healed. One rather old horse actually died from the attack of the ticks. A two-year-old imported Cleveland Boy colt, which took the premium as a yearling at our State Fair, was in good flesh, weighing about 1,000 pounds when turned in with the ponies. One of the owners, upon hearing of the condition of the ponies, took the colt and turned it into another pasture. No ticks were observed upon it, although careful search was made for them. In six weeks, this colt was hardly more than a skeleton. Ticks were curried off by the handful. As they were scraped from under the side of the abdomen of this colt, the blood stood in drops all over the surface and, indeed, dropped freely from the skin. The ears were full of the blood-suckers, while about the eyes and nose was one solid raw sore. This colt, if left a few days longer, must surely have died. Twenty-four wild ponies were caught and their hair saturated with kerosene oil. Six of these died—two almost immediately. Arsenic water, salt grease and kerosene were the only remedies tried.

Thus we have the facts of this invasion, if such it may be called, which is certainly very interesting and full of suggestion. I can easily understand the rapidity with which the horrible pests increased. Mr. Gould sent me, in a close tin box, about a dozen of the mature ticks. When I opened the box there were hundreds, I dare say thousands, of minute brown eggs—enough to stock several good-sized horses. As the ticks develop in a short time—probably three or four weeks—each of this thousand would scatter its hundreds of eggs, and thus soon, under favorable circumstances, all the horses in the country might be doomed.

One more point suggested by Mr. Gould's recital: He speaks of the "bodies of the ticks being torn from their heads." Really the ticks have no heads—just a body armed with a cruel sort of a bayonet. Many of us have noticed the same thing with the old-time wood-ticks. We would scarcely feel their presence when they would be buried deeply in the skin, and every attempt to loosen then would tear their bodies asunder, or, rather, tear their

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bodies from their mouth-organs and their attachment. This is owing to the fact that three portions of their awl-like mouth-organs are thickly set with barbs like those on fish-hooks. If a fish-hook will not tear out with its single barb, or a bee's sting with its half score, why should these lances, with their scores of barbs? They won't, and because of this arrangement these ticks become veritable stick-tights.

Mr. Gould asks two very pertinent questions: Will these ticks survive the winter? and, what is the best cure for the evil?

In answer to the first question I can only guess. As these ticks are natives and inhabitants of a sub-tropical region, I should presume that they would all succumb to our hard winters, and although they may live over, I shall be very much surprised, indeed, if they do. Animals, through the law of modification, are enabled to conform to slight changes, and through these in time to great ones; but any such paroxysmal change as this is very likely to prove fatal. As to remedies, I should suggest a tobacco decoction, an ointment of ulphur and kerosene and also an ointment of kerosene and lard. Pure kerosene is very severe in any case, and with animals so wounded, bruised and punctured as are the victims of these cruel ticks it would be terrible. I should use the three substances named above sparingly, and note which seemed to irritate the unfortunate sufferers least and was most efficient. I should also learn by experience how strong it was necessary to have these preparations to insure success. Of course, the less of the kerosene, the less irritation; so only just so much of this should be used as would insure success.

One more point: It is quite worth while to look sharp to such importations, and if we are liable to secure so much more than we bargain for, as in this case, it would be quite proper to quarantine against "Texas ponies." Surely, it would not be an unwise thing to consider such a quarantine at any time other than the fall of the year. I presume that fall importations would be attended by no such calamity.

I want to say a few words in regard to cattle vermin. It is of more interest than many farmers know. I can say that from ten to twenty per cent. of the cattle are suffering from vermin. I go into a herd of cattle and find lice on nearly every animal in the herd. I think twenty per cents of the cattle in Michigan have vermin upon them. This is a matter that should be looked into. The best places to look for them are on the shoulders, hips and thighs. There are three or four ways to get rid of them. First, throw dust upon them. If you have a quantity of dry earth and throw it over the cattle, you will free them of these lice. Second, use pyrethrum. If you will get this well among the hairs of the animal, you will kill these lice. I take a little bellows. This remedy is effective. The only objection is, you have to do it two or three times and if you are busy and do it once you will not follow it up. Another remedy is kerosene. Mix it with lard and put it on. The trouble in regard to this remedy is, it interferes with the looks of the animal. But the remedy I prefer is tobacco and it is effective. Get one-half or two-thirds of a pound of the cheapest tobacco, and put six quarts of boiling hot water upon it; then roll up your sleeves, take a sponge and go at the animal. You say "that is an awful chore." I went over an animal in eight minutes. This remedy is wonderfully efficient. I went over a colt and in three or four weeks I could hardly find one louse.

Question: Is it necessary to repeat this?

Prof. Cook: No, sir. There is one caution needed; if you should do this

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on a very cold day, you should blanket the animal and then it doesn't suffer; but if it is a warm day, they don't mind it without blanketing.

Question: Did you ever use carbolic acid and glycerine?

Prof. Cook: That has the same disadvantage. It does not look well. Tobacco is cheap and looks better, and is just as efficient. That is my opinion.

Question: You speak of dusting. Isn't dusting them with ashes as good as anything?

Prof. Cook: I would prefer dry earth.

Question: Isn't tobacco as well in a powdered form?

Prof. Cook: I think not, because you could not make it as thorough—when you wash them you can touch every point, and in dusting them that is impossible.

Mr. Garner: I thought it would be cheaper to get the powdered.

Prof. Cook: You can make a decoction for very little. You can get very cheap tobacco in any of our villages, I am sorry to say.

S. A. Sheldon: How about the grubs that burrow in cattles' backs during the winter?

Prof. Cook: I am glad you spoke of that. I know the bot-fly lays eggs in July and August upon the backs of cattle. The eggs hatch and the grubs work down through the skin and irritate the animal. This time of the year there are lumps on the back. The only harm I think they do is, if you kill the cattle and sell the skins they don't bring as much. I have noticed that fat cattle have them abundantly, so I don't think they do any serious damage. I want to say that as we clear up our forests, we are getting rid of these, and the only thing I can suggest is, put your cattle at a distance from wood lots.

L. Ladd: I would like to tell my experience with ticks. I drove my cattle into a lot where there was a large stack. When I discovered ticks on them, I washed them in strong soap-suds and lard and kept them out of that field and they were all right, but the next fall those things were still in the stack and I had to burn it up.

Question: I want to ask if there is any danger in using this insect powder on an animal?

Prof. Cook: No, sir; there is not. While it kills these ticks by contact, if the animal eats it doesn't hurt it.

A. D. Mead: I have a couple of very fine heifers, and they have a scab around their eyes. What causes it?

Prof. Cook: I suppose that is mange. I have noticed that a good deal.

Mr. Mead: One of my neighbors told me to rub it with a rough cloth, but I think it makes it worse.

Prof. Cook: I used lard and kerosene.

Mr. Allis: I used soft soap for the backs of my cattle and it sent them off.

Prof. Cook: It left holes in the skin, didn't it?

Mr. Allis: It soon healed up as smooth as though they had never been there.

Mr. Dickenson: I have had a little experience with mange. One of my animals died with it, and I would like to know if there is anything that will stop its growing.

Dr. Grange: I use oil of tar and compound tincture of benzoin. Any one of these remedies might be tried, and if it did no good in a day or

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two I would change, but I have found great benefit from the remedy I speak of.

At the South Haven Institute where this same paper was read, Mr. L. H. Bailey said: Last summer I put a colt in to pasture with some Texas ponies. I afterwards found my colt covered all over with these ticks. You could not lay your finger down on him without touching a tick. While in a good pasture he grew thin in flesh and nearly died. I washed him all over with a solution of two spoonsful of London purple in a pail of water applied freely with a sponge. One application killed the ticks. I also had a cow that had black lice and I killed every one on her with London purple.

DAIRY EXPERIMENTS.

[BY J. H. MONRAD, OF CHICAGO.]

[Read at Adrian Feb. 16, 1888, at the meeting of the Michigan Dairymen's Association.]

Although I cannot give this State credit for being as alive to the importance of the dairy interests as Wisconsin, still there is being done a great deal. You have an agricultural college, an experiment station and farmers' institutes; and, although there may be plenty of room for improvement as regards the dairy department in these institutions, yet, on the other hand, there has been, I regret to say, a complete lack of coöperation on the part of the farmers.

Just think of the unsolved problems that are scattered over the dairy field, which can only be solved by costly, exhaustive experiments! But, ladies and gentlemen, this question of hard cash is not the only point—we also want the farmers, the creamery men and the cheese makers to sacrifice some time and submit to some inconvenience, by inviting the experimenters to stop at their places and watch the practical work while they control it from a scientific standpoint.

In order to find out if any particular feed affects the quality of our butter, there are two tests to be made, one, preliminary, which proves if there is any immediate effect on the butter, and one conclusive test to prove the lasting effect of any particular food on the butter or cheese. The first-named test any farmer can make by setting the milk where it is protected against all outside influences and raising the cream quickly by the help of ice water; then skim and divide the cream into two lots; churn one perfectly sweet at once and ripen the other as usual. If there is any flavor from the food, it will show at once in the sweet cream butter. If there should be any taste or smell left in the butter from the soured cream, try if a little higher acid will not drive it away or hide it. If you succeed, you have proven that, although the flavor has been there, good, salable butter for immediate consumption can be made in spite of that particular food, always provided that you do not rely on your own or your friend's judgment but submit it to a competent commercial judge. This test is practically used by the Scandinavian Butter Preserving Co., when they refuse to buy anything but sweet cream butter for canning. They are thus enabled at once to find out if the dairymen have followed their instructions as regards the feed. The other test, to find out whether any particular food affects the keeping quality of the butter, is more complicated and is more expensive to make. First, we want to find two farms within easy distance where the same breed of cows are kept and

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where the same care and water can be given; it would be better still, of course, to divide a herd and keep each division in separate stables on the same farm. We then proceed to make out a feeding plan by which both herds get the same grain feed, not only the same in name but actually out of the same lot carefully mixed. One lot gets first-class, inimpeachable hay, while the other gets the food that we want to test—say ensilage. Feed thus for a week, at least, and then set your milk from both herds separately and treat it exactly alike, in fact, give it to the butter maker without letting him know which is which. When made, set samples of each lot aside in cold storage, let good commercial judges score it once a month for three or four months, keeping them in complete ignorance of what they are testing. Send samples of the new milk, skim milk, buttermilk and butter from each lot to the chemist for analysis. Repeat this test for one or two weeks, then reverse the feeding to the two herds; wait, as before, and repeat the experiments. If, then, both lots of butter keep equally well and if similar experiments in other states corroborate the result, then, and not until then, can we be sure that ensilage, for instance, being a fermented food, does not affect the keeping quality of the butter or cheese. You will observe the necessity of having all other conditions exactly alike but the one we wish to test.

When Professors Legelcke and Fjord made some experiments with skim cheese, they sent reliable, trained young men, with good thermometers, etc., to the factories. Samples for analysis were taken of the milk, of the whey and of the cheese fresh from the press. Annotations were made about every little detail in the manufacture, while the cheese maker went on his usual every-day way. If, for instance, they wanted to see the effect of the heat in the curing room, cheese of the same make was placed in different temperatures and from time to time submitted to commercial judgment.

In experimenting with any of the different tests for milk and cream, the first evident duty of the operator is to prove that he can repeat the test with the same milk again and again and get the same result. The next is to prove that the test gives practically the same result as the churn. For this purpose, we must have trained young men who can demonstrate that they are able to take 200 pounds of milk, divide into two lots and set, skim and churn each lot separately, and get, practically, the same result. To show you how nearly exact this can be done, I will give you the practical examination to which a young man was put in Denmark. He was given six 50-pound setters and 300 pounds of milk; this he divided up and set and churned in three lots, repeating the test for three days. From 100 pounds of milk he got the following pounds of butter:

First day—	3.45	3.48	3.465
Second day—	2.81	2.78	2.78
Third day—	3.455	3.46	3.46

The highest difference was, consequently, 3-100ths part of one per cent. of the milk, which may be considered near enough.

If, then, we want to try any of the different test systems, it is more practical to use this way of controlling them than to use the chemical analysis, but I want, nevertheless, to have the chemist's assistance in controlling the tests. In practically carrying out such tests, it is necessary to have a director, who leads everything, who, if you please, holds all the different threads in his hands, who controls not only the practical work, but also the scientific work,

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by giving double samples for analysis, thus proving their accuracy. It is also necessary to have a class of reliable, intelligent young men who can be trained for this work, and, in order to get this, I should say a National school would be the thing.

It is not enough, however, to have good experiments in Wisconsin, in New York or Illinois—we want them to be conducted on the same system in each state, so that they may supplement and corroborate each other when compiled at headquarters. I am happy to say that there is a tendency in this direction, and if, now, the dairy farmers will do their share and put their shoulders to the wheel and put their hands in their pockets, we may yet hope to get a practical result from the dairy experiments, which I hope will be made when the Hatch bill is passed.

In 1866, Denmark exported 6,730,500 pounds of butter to England, at an average price of 22½ cents; in 1883, it was raised to 35,358,400 pounds, at an average price of 29 cents. And this is the result of a hearty co-operation between the scientists and the practical dairymen.

MILK FEVER IN COWS.

[BY PROF. R. A. A. GRANGE, OF THE AGRICULTURAL COLLEGE.]

[Read at the Adrian meeting of the Michigan Dairymen's Association, Feb'y 15, 1883.]

In compliance with the request of your President, I beg to submit for your consideration some very favorable results I have obtained from the application of cold, wet packing in the treatment of parturient apoplexy or milk-fever. Before, however, taking up the practical part of the subject, I may be pardoned if I notice some of the chief characteristics by which this disease may be recognized; for this is a complaint which is not familiar, except, indeed, by name alone, to many of those breeders who only raise one or two animals annually, and, unfortunately, the number of animals that are invaded by it is on the increase from year to year, in direct ratio with the improvement in milch cattle. It is very important that it should be detected as soon as it makes its appearance; for I do not know any disease where the old adage of a "stitch in time," etc., can be more appropriately applied than to the one under consideration, and the remedy which I shall further on allude to has in those instances that I have applied it "nipped the disease in the bud."

SYMPTOMS.

In those cases which I have had an opportunity of observing in the early stage, the first evidence of something being wrong, was an exhibition of general restlessness and loss of appetite, accompanied in many instances by rigors, or, in other words, a chill; which is often more or less confined to the hind quarters; this is usually followed by what is called by veterinarians paddling of the hind feet, which consists in an uneasy movement of them, during which they are lifted, first one, then the other, from the ground, and put down again, not exactly with a kick, but rather a paddling-like motion. At this stage there is usually a profuse discharge of tears from the eyes, the countenance is one of anxiety and distress, when, singularly enough, the mother seems to lose all interest in her offspring and will not notice it. If

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the affected animal is required to walk, it will do so with a staggering gait, or will even drop behind, and fall down.

The secretion of milk is much diminished, or perhaps stopped altogether. The above may be considered as the symptoms of the first stage, to be followed, however, in somewhat rapid succession by those of

THE SECOND STAGE,

in which paralysis and impairment of those organs which control consciousness are most noticeable. The unfortunate animal will lie or fall down, and is often unable to rise, although it may make frequent attempts to do so, but eventually gives up, completely discouraged. At this point the head will be flung around to the right side and kept there persistently. The muscles upon the side of the neck become firmly contracted. Even when the head is brought by force into its natural position, a sort of kink will appear in the side of the neck toward which the head is thrown, and which I have seen remain for some days after the animal was able to walk about. In other instances, I have seen cases where the animals would rest their heads upon their horns, thrown back against the floor. In these cases, care must be taken by the attendant to prevent the animals from breaking off the flints, or horn cores, by the force they occasionally use in flinging their heads about.

IN THE THIRD STAGE

the animal drops into a profound sleep, when it will lie almost motionless, breathing, it may be, with a loud, snoring sound; the cheeks becoming inflated at every expiration; things go from bad to worse until death eventually closes the scene. Once in a while, though, one will meet with a case where this profound sleep appears to do the animal a great deal of good, for it will awaken to make rapid recovery.

The foregoing manifestations, together with others not perhaps so perceptible, will be observed to a greater or less extent in every pure case of this disease.

TREATMENT.

Before describing the manner of applying the pack, I would like to say a few words as to how I came to adopt this form of treatment. Some time ago, I was called upon to visit a cow attacked with some unknown disease (unknown to the owner). I was not long in determining that I had a case of parturient apoplexy to deal with, but in passing my hand over the animal's body, during my examination, I observed it to be bedewed with moisture, which I thought was water, it being a wet day, and asked the owner how he came to leave so sick a cow out in the rain; to which he replied that "she had not been out in the rain, but had been in the stable where I was then examining her since she was first taken." I must admit I was somewhat astonished, but a closer examination revealed that the moisture was sweat from the skin, and not rain-water. This most unusual occurrence caused me to reflect before proceeding with my usual treatment, but I soon concluded that nature was doing all she could to throw off, as it were, the disease, and did not feel disposed to interfere, with any of my own medicaments, but rather tried to help nature in her effort, by placing plenty of dry straw

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around the cow, and a light, warm blanket over her, and after attending to some of her more immediate wants, it being late at night, I left her, not before, however, telling the owner to come for me if she showed any evidence of not progressing favorably, and explained to him why I did not there and then give the cow some medicine. The next morning she was much better, and in the afternoon was able to walk about, although paralyzed and unable to rise the night before. With careful feeding she made an excellent recovery. This case and others have made a very strong impression on me that the diaphoretic (a remedy which causes a discharge of perspiration from the skin) form of treatment is the sheet anchor in this disease, but the difficulty was to get one whose virtues were not more that counterbalanced by other circumstances. I have often longed to try the Turkish bath in these cases; unfortunately, this kind of diaphoretic is not one that can be carried about conveniently, so that it becomes impracticable. I have tried the hot blanket with variable success. The difficulty with them is the trouble of applying them properly, and it is hard to get attendants to make the changes at the proper times, or to do so in such a way as to prevent the animal from getting a chill. Then the hot water is often inconvenient, the boiler, perhaps, being some distance from the stable, with many minor difficulties. The cold wet pack had from time to time been brought under my notice, and eventually I was induced to try it, and I must say that in my experience it has done all that could be desired. Then it can always be procured; not only that, but it can be procured readily, which is an invaluable advantage in this disease, for before the malady has had time to prostrate the animal, you have it headed off as it were, and before other remedies would have time to act, with this one the animal is often on a fair way toward recovery.

Before applying the cold wet pack, the owner or attendant must make up his mind to do the work thoroughly, or perhaps it would be better not to do it at all. So, for the benefit of those who wish to try it, I shall now describe in detail the manner in which I proceeded. Before putting on the sheet, I consider it a good plan to rub the animal, say for four inches on both sides of the center of the spine, and from the withers to the tail, with the best mustard, made up as for table use, and rub in for about fifteen minutes. This may be left on for two days. To apply the pack, take, say, a bed sheet and wring it out of cold water and wrap it around the cow; every part but the head may be covered; if one sheet is not large enough, sew two together. On top of the sheet place say two pair of the lightest and warmest blankets that can be obtained. Nothing could be better than these light cotton batting comforters so popular now in every household. Over all place an oil-cloth of some kind, or other close fabric that will keep the heat in. Those parts of the body, the legs, etc., which are not covered by the sheet must be covered with straw or other material, for they must be kept warm. In the course of half an hour or so after the pack has been applied, the body will be thrown into a profuse perspiration and will continue for an hour or so, but as soon as the skin begins to get cool, then preparation must be made for a second pack, and the changing must be quickly effected, or too long exposure will do more harm than the next pack will do good. If the wet sheets can be changed without removing the top coverings, all the better. Some animals are exceedingly restless during the progress of this disease, and it is these that give so much trouble and require constant watching to keep the pack in its place. Others will show much uneasiness of the head, which may be modi-

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fied by tying cold, wet cloths around and across their horns. With regard to the length of time the pack requires to be applied I can not say. In my own experience, the symptoms have always been relieved in twelve hours, sometimes in half that time. After it is removed care must be taken that the skin is kept moderately warm. While the symptoms last the cow must be keep from throwing itself over on its side. This may be done by packing sacks filled with straw against its sides. The milk should be drawn several times a day, and the bladder emptied. This latter operation generally requires the assistance of a veterinarian to show the attendant how to do it. When certain complications occur, such as distention of the rumen with gas, etc., the remedies which are calculated to relieve them must be used, but I think these should be left to a veterinary surgeon. But to return once more to the pack, I may say that I have had experience with it which justifies me in saying that it will often overcome the disease without any other treatment, and even if it does not in all instances, it will at all events keep it in abeyance until proper veterinary assistance can be procured. When the animal recovers it should be fed for a few days, say a week, on soft diet and receive a little daily exercise.

Mr. Boyd: If the cow is down and can't get up, how do you put on the wet pack?

Dr. Grange: It is as easy to apply the pack when she is down as when she is up. Tuck it in on all sides. Cows throw themselves very often upon their sides, and if they are not moved from that position they will not last long. If they are propped up, the pack can be put on. The whole body should be covered, as the object of the pack is to stimulate circulation of the blood.

Question: What per cent will live over 24 hours after an attack of that disease?

Dr. Grange: I would say seventy-five per cent. will live over 24 hours. I am merely guessing at it. I have known of quite a number of cases that have lived only two or three hours, but I think 75 per cent is an average.

Mr. Pickett: Is it true that keeping a cow in the stable and on dry feed is a preventive?

Dr. Grange: My experience is that they are better getting exercise. Of course, they are better in the stable than in a grass field, but I think they would be better exercising. I would prefer putting them in a stable than a rich pasture, but I would put them in a straw yard.

Question: Keep them away from rich, succulent food?

Answer: Yes, sir.

Question: How can we turn our cattle into clover without danger?

Dr. Grange: If the clover is a heavy growth they will usually eat enough to kill themselves. Don't leave them in but a short time; a bushel basketful won't hurt them. It doesn't make any difference whether the clover is wet or dry.

Question: How shall we treat horse distemper?

Dr. Grange: Keep the horse in a comfortable box stall with no draughts. Potassium stimulates the kidneys and helps the system rid itself of fever.

Question: Are cattle likely to lose their cud, and if so why?

Dr. Grange: Yes, by impaction of the rumen or first stomach, I usually administer purgative.

Mr. ———: I have a good heifer which is now rubbing herself as if she had lice, but she has none. Is it mange? She is in good condition.

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Dr. Grange: I think not, for if it were, your other cattle would have it. It is probably Eczema, produced by a derangement of the stomach. Epsom salts is good for it. Give a dose of a pound in a pound of water, if a good sized animal. Scab, mange, itch, and rubbers are all one disease, the result of a parasite. The disease will manifest itself in twelve hours after exposure. Corosive sublimate is good but is dangerous. A better remedy is, equal parts of compound tincture of benzoin and spirits of tar

CONTAGIOUS DISEASES OF LIVE STOCK.

[BY PROF. H. A. A. GRANGE.]

[Delivered at Ithaca, Cassopolis and Tecumseh.]

[The following article, though not presented at the Adrian meeting, is here printed with the proceedings of that meeting because of its allied subject.—EDITOR.]

MR. PRESIDENT, LADIES AND GENTLEMEN: During the past few years it has been my privilege, as State veterinarian, to visit many localities in this State, for the purpose of investigating certain contagious diseases, reported from time to time to be prevalent among the live stock of the locality, and although in most instances the reports were correct, and the disease dealt with immediately by the Live Stock Sanitary commission, yet, on the other hand I have been called with the greatest haste to arrest the progress of some virulent and contagious disease, supposed to exist in the locality, when careful examination proved the disorder to be some manageable complaint or acute attack of a non contagious disease, which in some instances has been the means of creating the most unnecessary alarm for the time being, and in one instance that I can call to mind the alarm amounted almost to a panic. for before my examination of the diseased animals, farmers thought them affected with pleuro-pneumonia of the contagious variety, a disease much dreaded in this country. So to aid in disseminating knowledge with reference to these disorders, I have thought proper to speak at our Farmers' Institutes concerning them, and perhaps I cannot do better than take up the most serious of them at once, for although they are all or nearly all serious, yet I think "Contagious pleuro-pneumonia" is regarded as standing in the front rank in that respect, as perhaps a little study of the disorder will show; and of it I may say that it is a contagious fever peculiar to the bovine race, and never attacking other animals as far as is known. Another singular circumstance in this disease is that it invades the lungs, and lungs only, of the affected animal, the other parts of the body appearing healthy, although the animal becomes much reduced and debilitated during the progress of the complaint, which often takes from four to eight weeks and even longer to run its course, but it does occasionally carry off an animal in three or four days. This disorder is known under a variety of synonyms; for instance it is called zymotic-pleuro-pneumonia, the term zymotic often being applied to those diseases which are dependant on a virus, or contagious matter, of a fermentable nature. It is also called pleuro-pneumonia epizõotica, the term epizõotic being applied to diseases which attack a number of animals at the same time. There are a host of other names but as we seldom if ever hear them in this country, and as they are usually local names, I think it is unnecessary for me to mention them here.

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Turning for a few moments to the history of this complaint, I may say that the probability is that it will never be known when the first case, or even outbreak occurred, and in this connection I have often wondered if this was one of the scourges that attacked the cattle of the Egyptians during the bondage of the Israelites, indeed the name "pulmonary murrain," which is sometimes applied to it, would lead one to think so, though the term murrain is often applied to other diseases which are of a very fatal or deadly nature. Be this as it may, we have no reliable account of the disease until 1769, when Bourgelot, a French veterinarian, and the founder of the first veterinary college, described this disorder in a scientific manner, but it did not appear to have become very widely spread until the commercial relations between countries began to develop, and as cattle were sent from east to west, and vice versa, so were the germs of this pestilence. In 1802, a most serious outbreak occurred in Prussia, and since that period it has been oscillating in a somewhat erratic manner over various parts of the globe; for instance, in 1824 it went east to Russia, then in 1827 it went west to Belgium, and in 1833 it went north to Holland, from here it came to Britain in 1841; and in 1843 it bounded across the Atlantic to Brooklyn. Shortly after it visited Denmark, Finland and southern Africa, later on it found its way out to Australia and New Zealand. Up to within quite a recent period its geographical distribution in this country was quite limited, but a year or two ago it found its way for the first time, west of Pennsylvania, though it is now thought to be eradicated from the western States. I am glad to be able to say that it has never visited Michigan, though I have been frequently called to investigate supposed outbreaks of it, but always found some other disease causing the alarm.

The symptoms of this disease being of much interest I will describe the prominent ones in connection with it, but have to say that one of the most unfortunate circumstances in connection with them is, that the progress of the disease is so often slow, and insidious, they are liable to pass unnoticed, except by an acute observer, and in a contaminated district all stockmen should make themselves familiar familiar with the clinical thermometer, a small instrument used for measuring the temperature of the body, and when it indicates say 103° Fahr., we may be tolerably certain that this disease, or some other, is at work on the economy, but if it happens to be the disease in question that is doing the mischief, the rise in temperature will be accompanied with a dainty appetite, and usually a mild cough will be heard; shortly the signs of distress become more evident, for instance the cough becomes dull, harsh, and painful. The animal will arch its back, knuckle at the hind fetlocks, and protrude its head and neck, the breathing becomes accelerated, and the pulse much quickened, which eventually becomes very feeble. As the disease still further advances, the breathing becomes more painful, being often accompanied with a moan or grunt, and in many instances there is considerable discharge from the nostrils. Those familiar with thoracic sounds, will be able to detect friction sounds caused by the inflammation of the covering of the lungs (the pleura). This may be followed by suspension of the breathing sounds, which is indicative of the conversion of the lung substance into a solid mass through which little or no air passes. The animal now becomes an emaciated object, with its skin and flesh sticking tightly to its bones, when it will eventually become unconscious and soon die. There is a percentage though, that do not succumb to the disease as above described, and

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eventually make an apparent recovery: but I believe such cases are more dangerous to a stock raising country than was, up to within the last two years, generally supposed, for the extensive autopsies held among the cattle of Chicago, have gone to show that the poisonous matter of the disease may become enclosed in a cyst or sack, in such a manner that little if any inconvenience is caused by its presence, and the cow may thrive tolerably well for a long time. In my first biennial report to the Michigan Live Stock Sanitary Commission I mention one case, which bears so forcibly on the point that I take the liberty of repeating it. In Chicago in the fall of 1886, "I saw a *post mortem* in one case whose history showed the danger to be apprehended from apparently recovered cases in such a marked degree that I think proper to report it here. The animal's owner stated to me that last July, (1886) the cow in question was taken with what he thought to be an ordinary cold, but as she did not seem to recover from it in the usual time, he consulted some of his neighbors, and they suggested that she might have contagious-pleuro-pneumonia, (it was prevalent at that time) and after some consideration he concluded to consign her to the grave, but on the day he had set apart for her destruction, she appeared to be somewhat better, so much so, that he determined to let her live a little longer, and from that day onward she continued to improve, until he thought she was perfectly well, when she increased in weight from time to time, and was brought to the slaughter house as soon as she was thought fat enough to be killed, with some of his other cattle. A *post mortem* was made in due course, and the disease was plainly exhibited by the presence of a cyst, containing say a pint of pulpy matter in one of her lungs. The probability is, if she had been allowed to live, and subsequently exposed to cold or other exciting cause, the disease would have burst forth in a virulent form, perhaps after she had been shipped to some other part of the country, for she might easily have been sold for a sound cow."

THE MEAT OF AFFECTED ANIMALS AS FOOD FOR THE HUMAN FAMILY.

I may say with regard to eating the meat of diseased cattle, it has been done in some countries with impunity, for many years without an accident; one French statistician reports, that in one of the provinces of France, the flesh of 18,000 head has been consumed at the rate of about 1,000 head per annum, and that for a period of nineteen years, the sanitary condition of the people eating it was unimpaired. In this country hundreds if not thousands of affected cattle have been consumed, and not an accident has occurred that I am aware of; but if the disease is advanced in the acute stage the flesh is not considered fit for human food.

TREATMENT.

In a country like this where the disease has not gained a permanent foothold, I think that treatment should not be permitted, and that all exposed or infected animals should at once be destroyed. In some countries preventive measures have been adopted and under certain circumstances are allowable. But in this country, and as things are now, such an operation as is performed to prevent the disorder should not be tolerated for a moment. The operation is inoculation, and consists in placing some of the virus from the lungs of a diseased animal under the skin of a healthy one, but as it is not

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at all likely that it will be performed here I will not tax you with a description of the manner of performing it, and the handling of cattle threatened with this disorder should in my opinion be entirely in the hands of experts conversant with the disorder. Another disease which has given rise to more or less alarm in this State from time to time is glanders and farcy. I say glanders and farcy because, as I shall endeavor to show, they are modifications of one and the same complaint, the term glanders being applied to that form of the disease which attacks the organs of respiration, as the lining membrane of the nose, causing a discharge from it, as well as marking it in most cases with ulcerated patches. Certain glands in the neighborhood of the head are also affected, while farcy is that form of the disease that invades the skin on various parts of the body, as well as the tissues immediately beneath it.

Again we meet with many cases where both forms of the disease exist in the same animal. The most convincing proof we have of them being one and the same complaint is that if the matter which comes from the farcy buds, as they are called, is inoculated into a healthy horse, glanders may be produced, while the inoculation of the virus of glanders often produces farcy.

The cause of this disease may be summed up in one word, *contagion*, for recent investigation has proved beyond all reasonable doubt that it is the result of invasion of the economy by a specific germ. Notwithstanding that, however, I think there are many other conditions which may be looked upon as secondary causes, as it were, and they may be found in the debility occasioned by such diseases as strangles, catarrhal fever, influenza, exposure to cold without sufficient nourishment, the trials of long military campaigns, or indeed anything which induces debility. I think the secondary causes act by rendering the animal more susceptible to the poison, and that through their influence the immunity before possessed is destroyed.

The symptoms of glanders are usually regarded under two heads; first, the acute form of the disease which may run its course comparatively quickly, leaving the animal a prostrated, loathsome looking object in from eight to ten days, the disease being ushered in with rigors or a chill, which is soon followed by high fever, accompanied with hurried breathing and general distress. Soon a watery discharge comes from one or both nostrils; this quickly thickens into sticky matter that adheres to hair and skin, wherever it is applied; the lining of the nostrils become ulcerated, when the larynx and lungs become involved, and tumors form under the jaws.

Next we have chronic glanders, which is much more insiduous and lasting in its course. It is the variety we generally meet with. This form will begin like an ordinary cold, there being a discharge from one or both nostrils, but there are cases recorded where no discharge is present; but in typical cases there is always a discharge. The lining of the nostrils becomes ulcerated and tumors form under the jaw, sometimes one, sometimes two. The above symptoms are often intermittent, but they generally go from bad to worse, and eventually the animal succumbs to the disease. Once in a while we meet with cases where there is not any external manifestation of the disease, and it may only be discovered on a *post mortem* examination, so that in all cases of the examination of horses after death, too much care cannot be exercised to prevent inoculation of the operator. Other diseases may be and often are mistaken for glanders, but by observing closely the chain of

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symptoms they are not so liable to happen. With regard to the treatment of this disease I think that there is so much risk in it, that the sooner the affected animal is under the ground the better, for the most disastrous results have occurred in the human family, with some who have persisted in treating the disease. One peculiarity in this malady that is worthy of notice, is that the entire bovine race are supposed to possess complete immunity from its influence, and I have never been able to find a single instance where the ox was affected with glanders.

FARCY,

like glanders, is considered under two heads, not that there is much difference between them, except that one runs its course more quickly. In farcy the limbs as well as parts of the body may be covered with running sores, which often heal up, only to burst out in some other part. These sores are generally raised in the form of nodules, they may vary in number from one to several hundred. The worst case I ever saw appeared to be a mass of them, and the owner assured me that three weeks before I saw the case, that the animal's coat was as sleek as any horse he ever saw. This loathsome looking object died a day or two after I saw it, notwithstanding that the owner persisted in treating it, much against my advice, however. With regard to the treatment I think that in well marked cases the same disposition should be made of the animals as in glanders, namely, to destroy them, bury them deeply, or better still, cremate the carcasses.

TEXAS FEVER

is a disease that occasionally visits this State creating for the time much alarm, and sad havoc among those animals which it attacks. The disease presents some very peculiar and interesting features that differ from any disease I know of, and the first one worthy of note is that cattle coming from the affected districts, carry with them the germs of a disease which invades northern cattle in a way that causes their death in a very short time; while the southern cattle remain to all intents and purposes, perfectly healthy. Then another singular feature is that that the sick northern native will not communicate the disease to other natives, though there are one or two cases where they are supposed to have done so. A very large percentage of northern cattle exposed to the disease contract it, and if not treated will die. The disease generally runs a brief course, say three or four days. Frost has a very disastrous effect on the virus of this disease. The complaint is almost entirely confined to the hot months of summer.

The symptoms of this disease though differing somewhat in individuals, are mostly well marked, and in typical cases the animal will first be noticed not to be eating in its usual way, if indeed it eats at all. Then what is called the moping stage begins, the ears droop, the head is depressed, the animal will stand with its back arched, and appear very dull, the breathing now becomes accelerated, and the pulse small and quick. Shortly after the first stage, the animal will appear more distressed, the skin becomes dry and harsh, and nervous symptoms present themselves. Some animals lie down and have much difficulty in getting up, while others will stand persistently, or stagger about when forced to walk; towards the close of the disease some

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become very restless, and eventually delirious, rush about, perhap violently, and suddenly drop dead; while others at this stage lie down, drop into a profound sleep, and die without a struggle.

TREATMENT.

One of the first things to be done in the treatment of this disease, is to get the animal in a comfortable place, well ventilated and cool. The food must be of a soft nature, bran mashes, young grass, linseed gruel and the like.

The medicinal treatment consists in the administration of those remedies which are calculated to destroy germs, and at the same time arrest the progress of the disease. For this purpose Chinoidine has been used with success; the dose is regulated by allowing one drachm for every hundred pounds of the animal's weight; these doses may be given twice a day for two days.

But as prevention is better than cure, little danger need be apprehended from this complaint, provided northern natives are not allowed in contact with the so called Texas cattle in the summer time, nor should northern cattle even be driven across the trail of a Texas herd in the hot months of the year; and by observing these precautions, northern cattle can scarcely contract this fever.

HOG CHOLERA

is another contagious fever that is often brought under our notice, and one which is of a very destructive nature, carrying off a large proportion of the animals it attacks, while those that it does not destroy, are often left in such a condition that for humanity sake they are killed. The symptoms vary somewhat, and some seasons seem to be armed with more virulent germs than others. The disorder is usually brought in with a chill which is at once followed by fever, the animal becomes dull, and much prostrated, being unwilling if not unable to rise, the appetite becomes impaired the creature walks with a staggering gait, has a hoarse, husky cough, and the skin in many instances is marked by red patches. The bowels become affected and the animal experiences much pain from them, which is evidenced by its pitiful cries. The breathing becomes quickened; paralysis often exists, and eventually the animal will die in a fit of convulsions, sometimes even the worst cases make a good recovery, though such a favorable termination is very rare, and as a rule those bad cases that do recover, are not good for much, as it costs so much to fatten them.

TREATMENT.

Carbolic acid has gained much favor in the cure of this disease and is given by allowing ten drops of a 95 per cent solution for every 100 pounds of the animal's estimated live weight three times a day. The medicine should be diluted with about 100 parts of water, and the animal should be kept in a comfortable place and fed on laxative food.

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LIVE STOCK

SANITARY LAWS

OF MICHIGAN.

LIVE STOCK SANITARY COMMISSION.

CHARLES F. MOORE, St. Clair. HENRY H. HINDS, Greenville.
JONATHAN J. WOODMAN, Paw Paw.

STATE VETERINARIAN, E. A. A. GRANGE, Lansing.

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AN ACT

TO PROVIDE FOR THE APPOINTMENT OF A STATE LIVE STOCK SANITARY COMMISSION AND A STATE VETERINARIAN, AND TO PRESCRIBE THEIR POWERS AND DUTIES, AND TO PREVENT AND SUPPRESS CONTAGIOUS AND INFECTIOUS DISEASES AMONG THE LIVE STOCK OF THE STATE.

[Act No. 182, Laws of 1885.]

The State live stock sanitary commission.

To consist of three persons, practical agriculturists.

To be appointed by the Governor, etc.

Term of office.

When to be appointed.

Veterinary surgeon.

Term of office.

SECTION 1. *The People of the State of Michigan enact*, That a commission is hereby established which shall be known under the name and style of "The State Live Stock Sanitary Commission." The commission shall consist of three commissioners who are practical agriculturists and engaged in the live stock industries of the State, who shall be appointed by the Governor with the advice and consent of the Senate. One shall be appointed for the term of six years, one for the term of four years, and one for the term of two years, whose term of office shall commence on the second Tuesday of July of the year in which they are appointed and shall continue until their successors are appointed and qualified. And at each succeeding biennial session of the Legislature there shall be appointed in like manner one commissioner who shall hold his office six years or until his successor is appointed and qualified. The Governor shall also appoint, with the advice and consent of the Senate, a competent and skilled veterinary surgeon for the State, who, at the time of such appointment, shall be a graduate in good standing of a recognized college of veterinary surgery and who shall hold his office two years from the second Tuesday of July of the year he is appointed and until his successor is appointed and qualified. The Governor shall also appoint every two years thereafter a competent and skilled veterinarian having the qualifications above mentioned, whose term of office shall be for two years or until his successor is appointed and qualified.

Constitutional oath of office.

SEC. 2. Said commissioners and veterinary surgeon before they enter upon the duties of their office shall each take and subscribe the constitutional oath of office and file the same with the Secretary of State.

Compensation of commissioner and veterinary surgeon.

SEC. 3. Each commissioner shall receive the sum of three dollars per day and necessary expenses for the time actually spent in the discharge of his duties; and the veterinary surgeon shall receive the sum of five dollars per day and necessary expenses for time when employed.

Duty of the commission. Quarantine regulations, etc.

SEC. 4. It shall be the duty of the commission to protect the health of the domestic animals of the State from all contagious or infectious diseases of a malignant character, and for this purpose it is hereby authorized and empowered to establish, maintain, and enforce such quarantine, sanitary, and other regulations as it may deem necessary.

Duty of persons to report contagious or infectious disease to health officer, etc.

SEC. 5.[a] It shall be the duty of any person who discovers, suspects, or has reason to believe that any domestic animal belonging to him or in his charge, or that may come under his observation, belong to other parties, is affected with any disease, whether it be a contagious or infectious disease, to immediately report such fact, belief, or suspicion to the Live Stock Sanitary Commission, or a member thereof.

SEC. 6.*

Commission to quarantine.

SEC. 7. The commission or any member thereof to whom the existence of any infectious or contagious disease of domestic animals is reported shall forthwith proceed to the place where such domestic animal or animals

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[a] As amended by Act No. 105, Public Acts 1887.

*Section 6 was repealed by Act No. 105, Public Acts 1887.

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are and examine the same, and if in his or their opinion any infectious or contagious disease does exist, he or they shall prescribe such temporary quarantine and regulations as will prevent the spread of the contagion or infection, and notify the State Veterinarian, who shall forthwith proceed to the place where said contagious or infectious disease is said to exist and examine said animal or animals and report his or their finding to the said commission, who then shall prescribe such rules and regulations as in their judgment the exigencies of the case may require for the effectual suppression and eradication of the disease, and for that purpose the said commission may list and describe the domestic animals affected with such disease and those which have been exposed thereto and included within the infected district or premises, so defined and quarantined with such reasonable certainty as would lead to their identification, and no domestic animal liable to become infected with the disease or capable of communicating the same shall be permitted to enter or leave the district, premises, or grounds so quarantined, except by the authority of the commission. The said commission shall also, from time to time, give and enforce such directions, and prescribe such rules and regulations as to separating, mode of handling, treating, feeding, and caring for such diseased and exposed animals as it shall deem necessary to prevent the two classes of animals from coming in contact with each other, and perfectly isolate them from all other domestic animals which have not been exposed thereto and which are susceptible of becoming infected with the disease, and the said commission and veterinarian are hereby authorized and empowered to enter upon any grounds or premises to carry out the provisions of this act. When in the opinion of the commission it shall be necessary to prevent the further spread of any contagious or infectious disease among the live stock of the State, to destroy animals affected with or which have been exposed to any such disease, it shall determine what animals shall be killed, and appraise the same as hereinafter provided, and cause the same to be killed and the carcasses disposed of as in their judgment will best protect the health of domestic animals of the locality.

To notify the State veterinarian.

To report to the commission.

Powers and duties of the commission and veterinarian.

SEC. 8. When the commission shall have determined the quarantine and other regulations necessary to prevent the spread among domestic animals of any malignant, contagious or infectious disease found to exist among the live stock of the State, and given their orders as hereinbefore provided, prescribing quarantine and other regulations, it shall notify the Governor thereof, who shall issue his proclamation proclaiming the boundary of such quarantine and the orders, rules and regulations prescribed by the commission, which proclamation may be published by written or printed handbills posted within the boundaries or on the lines of the district, premises, places or grounds quarantined: *Provided*, That if the commission decide that it is not necessary, by reason of the limited extent of the district in which such disease exists, that a proclamation should be issued, then none shall be issued, but such commission shall give such notice as may to it seem best to make the quarantine established by it effective.

To notify the Governor of quarantine.

Governor to issue quarantine proclamation.

SEC. 9. Whenever the commission shall direct the killing of any domestic animal or animals it shall be the duty of the commissioners to appraise the animal or animals condemned, and in fixing the value thereof the commissioners shall be governed by the value of said animal or animals at the date of appraisement.

Commission to appraise animal ordered killed.

SEC. 10. Whenever any live stock shall be appraised and killed by order of the commission, it shall issue to the owner of the stock so killed a certificate showing the number and kind of animals killed, and the amount, in their judgment to which the owner is entitled, and report the same to the Governor of the State, which certificate, if approved by the Governor, shall be presented to the Auditor General, who shall draw his warrant on the State Treasurer for the amount therein stated, payable out of any money in the treasury not otherwise appropriated.

To issue a certificate to owner.

To report the same to the Governor.

Auditor General to draw his warrant for amount.

SEC. 11. When any animal or animals are killed under the provisions of this act, by order of the commission, the owner thereof shall be paid therefor the appraised value as fixed by the appraisement hereinbefore provided for: *Provided*, The right of indemnity on account of animals killed by order of the commission under the provisions of this act, shall not extend to the owners of animals which have been brought into the

Owner to be paid for animal killed.

Proviso.

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State in a diseased condition, or from a State, country, territory or district in which the disease with which the animal is affected, or to which it has been exposed, exists. Nor shall any animal be paid for by the State which may be brought into the State in violation of any law or quarantine regulation thereof, or the owner of which shall have violated any of the provisions of this act, or disregarded any rule, regulation, or order of the Live Stock Sanitary Commission or any member thereof. Nor shall any animal be paid for by the State which came into the possession of the claimant with the claimant's knowledge that such animal was diseased, or was suspected of being diseased, or of having been exposed to any contagious or infectious disease.

Keeping a domestic animal affected with any contagious disease a misdemeanor.

SEC. 12. Any person who shall have in his possession any domestic animal affected with any contagious or infectious disease, knowing such animal to be so affected, or after having received notice that such animal is so affected, who shall permit such animal to run at large, or who shall keep such animal where other domestic animals not affected by or previously exposed to such disease may be exposed to its contagion or infection, or who shall sell, ship, drive, trade or give away such diseased animal or animals which have been exposed to such infection or contagion, or who shall move or drive any domestic animal in violation of any direction, rule or regulation, or order establishing and regulating quarantine, shall be deemed guilty of a misdemeanor, and upon conviction thereof, shall be fined in any sum not less than ten dollars nor more than five hundred dollars for each of such diseased or exposed domestic animals which he shall permit to run at large or keep, sell, ship, drive, trade or give away in violation of the provisions of this act: *Provided*, That any owner of any domestic animal which has been affected with or exposed to any contagious disease may dispose of the same, after having obtained of the State veterinarian a certificate of health for such animal.

Penalty.

Proviso.

Penalty for bringing diseased animals into the State.

SEC. 13. Any person who shall knowingly bring into this State any domestic animal which is affected with any contagious or infectious disease, or any animal which has been exposed to any contagious or infectious disease, shall be deemed guilty of a misdemeanor and upon conviction thereof shall be fined in any sum not less than one hundred dollars nor more than five thousand dollars.

Penalty for refusing to allow the veterinarian, etc., to examine stock.

SEC. 14. Any person who owns or is in possession of live stock which is affected, or which is suspected or reported to be affected with any infectious or contagious disease, who shall willfully prevent or refuse to allow the State veterinarian or commissioner or other authorized officer or officers to examine such stock, or shall hinder or obstruct the State veterinarian or other authorized officer or officers in any examination of or in any attempt to examine such stock, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined in any sum not less than ten dollars nor more than five hundred dollars.

Penalty for violation of act.

SEC. 15. Any person who shall willfully violate, disregard or evade, or attempt to violate, disregard or evade any of the provisions of this act, or who shall willfully violate, disregard or evade any of the rules, regulations, orders or directions of the Live Stock Sanitary Commission establishing and governing quarantine, shall be deemed guilty of a misdemeanor and upon conviction thereof shall be fined in any sum not less than ten dollars nor more than five hundred dollars.

Authorized to employ persons and purchase supplies, etc.

SEC. 16. The commission provided for in this act shall have power to employ at the expense of the State such persons and purchase such supplies and material as may be necessary to carry into full effect all orders by it given.

May call upon the sheriff, etc., to execute orders.

Compensation.

May arrest.

Duty of prosecuting attorney.

SEC. 17. The commissioners shall have power to call upon any sheriff, under-sheriff, deputy-sheriff, or constable to execute their orders, and such officers shall obey the orders of said commissioners, and the officers performing such duties shall receive compensation therefor as is prescribed by law for like services, and shall be paid therefor in like manner. And any officer may arrest and take before any justice of the peace of the county any person found violating any of the provisions of this act, and such officer shall immediately notify the prosecuting attorney of such arrest, and he shall prosecute the person so offending according to law.

Governor to issue proclama-

SEC. 18. Whenever the Governor of the State shall have good reason to believe that any dangerous, contagious, or infectious disease has be-

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come epizoötic in certain localities in other States, territories or countries, or that there are conditions which render such domestic animals from such infected districts liable to convey such disease, he shall by proclamation prohibit the importation of any live stock, of the kind diseased into the State, unless accompanied by a certificate of health given by a duly authorized veterinary surgeon; and all such animals arriving in this State, shall be examined immediately by the commission or some member thereof, and if he or they deem necessary he or they shall have said animals inspected by the State veterinary surgeon, and if in his opinion there is any danger from contagion or infection, they shall be placed in close quarantine until such danger of infection or contagion is passed, when they shall be released by order of said commission or some member thereof.

tion prohibiting the importation of live stock, etc.

To be examined and quarantined.

SEC. 19. For the purposes of this act each member of the Live Stock Sanitary Commission is hereby authorized and empowered to administer oaths and affirmations.

May administer oaths, etc.

SEC. 20. This commission is hereby authorized and required to coöperate with any board or commission acting under any present or future act of Congress for the suppression and prevention of contagious or infectious diseases among domestic animals, and the same right of entry, inspection and condemnation of diseased animals upon private premises is granted to the United States board of commission as is granted to the commission granted under this act.

Required to cooperate with boards acting under act of Congress.

Authority of U. S. Board.

SEC. 21. The commission shall make biennially a detailed report of its doings to the Governor, which report shall be transmitted to the Legislature at its regular biennial session.

To report to the Governor, etc.

SEC. 22.[a] This act shall be construed so as to include sheep and horses.

Sheep and horses included.

[a] As amended by Act No. 47, Public Acts of 1887.

Ordered to take immediate effect.

Approved June 10, 1885.

[b]SEC. 23. Any railroad company, navigation company, or other corporation, or common carrier, who shall knowingly or willfully violate, disregard, or evade any of the provisions of this act, or who shall willfully violate, disregard, or evade any of the rules, regulations, orders, or directions of the live Stock Sanitary Commission establishing or governing quarantine, or who shall evade, or attempt to evade any quarantine proclamation of the Governor of this State declaring quarantine limits, shall forfeit and pay to the people of the State of Michigan not less than five hundred dollars, nor more than five thousand dollars, for each and every offense, and shall be liable for all damages caused to any neat cattle by its or his failure to comply with the requirements of this act.

Relative to violation of act by railroad companies, etc.

[b] Section 23 was added by Act No. 105, Public Acts 1887.

This act is ordered to take immediate effect.

Approved May 13, 1887.

AN ACT

TO REGULATE AND PROVIDE FOR THE CARRYING, YARDING AND FEEDING OF SO-CALLED TEXAS CATTLE WHILE IN TRANSIT INTO OR ACROSS THIS STATE BETWEEN THE FIRST DAY OF APRIL AND THE FIRST DAY OF NOVEMBER OF EACH YEAR.

[Act No. 198, Laws of 1885.]

SECTION 1. *The People of the State of Michigan enact*, That it shall not be lawful to transport any neat cattle into or across this State, yard or feed the same, that have been reared or kept south of the thirty-sixth parallel of north latitude, and that have not subsequently been kept continuously at least one winter north of said parallel, and which may be brought within the limits of this State between the first day of April and the first day of November following, except in the manner hereafter provided.

Transportation across, yarding, etc., of certain cattle, unlawful.

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Duty of railroad transporting certain cattle.

SEC. 2. It shall be the duty of all railroad companies doing business in this State to receive and transport while in this State, the class of cattle mentioned in section one, only in cars that are branded or lettered legibly and distinctly, and in plain view, the words "For the transportation of Texas cattle only;" and they shall not permit or allow any other class of cattle to enter those cars between the first day of April and the first day of November following: *Provided*, That cattle coming from other States for transportation through this State when it is impossible to ascertain where they came from may be shipped in such cars, but shall be treated in all respects as coming from the country south of the thirty-sixth parallel of north latitude.

Proviso.

Care of certain cattle at stock yards.

SEC. 3. It shall be the duty of any railroad company, stock yard company, or private individual owning and operating any stock yard in this State, to receive and feed the class of cattle mentioned in section one only in yards separate and apart from yards used for the feeding or yarding of other cattle; and these yards shall be in the immediate vicinity and contiguous to a railroad side track so that these cattle may not pass over any open common that might be crossed by other cattle; and said yards shall have a sign posted at each entrance thereto, on which shall be plainly lettered "For the yarding of Texas cattle only," and no other cattle shall be admitted to these yards between the first day of April and the first day of November of each year.

Location of such yards; passing to.

Entrance sign.

Penalty for violation.

SEC. 4. Any railroad company, stock yard company, or private individual owning any stock yard in this State, who shall violate any of the provisions of sections one and two of this act, shall forfeit and pay to the people of the State of Michigan not less than fifty dollars nor more than five hundred dollars for each and every such offense, and shall be liable for any and all damages caused to any neat cattle by their failure to comply with the requirements of this act.

Fine.

Liability for damages.

Certain violation a misdemeanor.

*SEC. 5. Any person or person [persons] who shall knowingly or willfully place or attempt to place any neat cattle, or others than those mentioned in section one, in any car or yard provided for in section two or three of this act, and branded and lettered as therein provided for between the first day of April and the first day of November following, shall be deemed guilty of a misdemeanor, and on conviction thereof shall be fined not less than ten dollars nor more than one hundred dollars, or be imprisoned not less than ten days, nor more than sixty days, or both such fine and imprisonment in the discretion of the court.

Punishment.

Approved June 16, 1885.

* As amended by Act No. 57, Laws of 1887.

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MISCELLANEOUS PAPERS PRESENTED AT INSTITUTES AND ELSEWHERE.

THE RELATION OF MECHANICS TO AGRICULTURE.

[BY PROF. W. F. DURAND.]

[Read at the Cassopolis Institute Feby. 14, 1868.]

At the commencement of what I have to say, it would be, perhaps, well to state clearly what is meant by the word *mechanics* in this connection.

As a definition, then, we may say that *mechanics* is that science by the application of which man is enabled either to use his own strength to better advantage, or else to use for his own ends, strength or force derived from external sources.

To illustrate: 1. A *crowbar*, the use of which in rasing a weight, involves a certain principle of mechanices, and enables a man to use his strength to better advantage than he could without it.

2. A *mowing machine*, which involves several mechanical principles, enables the farmer to utilize the strength of his team of horses for mowing, and so to cut his grass with little personal effort.

3. The *steam thresher*, involving a great number of mechanical principles and elements, enables the farmer to control and use for his own ends the vast supply of power stored up in coal.

With this broad definition of *mechanics* it is plainly seen that all human progress from the savage state up, has been closely linked with its development and application.

As to what this application has accomplished for agriculture, we all know. If we go back to the most primitive condition we should have, for instance, a half naked savage scratching the ground with a stick, sowing therein his grain, rubbing out the kernels between his fingers and bruising them between two stones, thus forming a coarse meal from which, by mixing with water, he can make cakes to be baked in the ashes.

The other side of the picture we all know. By the application of mechanics the farmer can not only accomplish a thousand fold more with his own strength, but in addition he calls to his aid the varied forces of nature, cattle power, horse power, wind power, water power and steam power.

It must not be supposed from this, however, that a high degree of what we term civilization was not possible except as combined with a high development of mechanic arts. The Greeks, perhaps, most conspicuously of ancient nations, show that such was not the case.

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In their age, however, they developed these arts as high if not higher than any of their neighbors and it would probably be safe to say that in any given age of the world, the most highly civiiized people were those who had carried to the highest point the development and application of the mechanic arts.

This development and application of mechanical principles is partly a result of a high civilization, but very largely it stands as its cause.

This is not hard to see; for as mankind is more and more relieved from the necessity of a constant personal struggle for existence, so much the more opportunity will there be for a development of his mental, moral, and religious faculties.

What are then, some of these principles, the application of which has had such an important part in our civilization? The study of the principles in the abstract is beyond the limits of our time this evening, but the most important may be illustrated by some of the elementary portions into which all machines may be divided.

Take first the lever; this involves a far reaching and important principle and we see it involved in such tools as the *crowbar, tongs, scissors, old-fashioned well-sweep, wheel and axle,* etc., while it is less plainly apparent in a vast number of tools, among which may be mentioned the *hoe, ax, knife, pitchfork,* all *wheeled vehicles,* etc.

Of course these tools involve other elements as well, yet in one form or another, the principle of the lever is involved also.

Take again the principle involved in the rolling of a barrel up a plank into a wagon. This is commonly known as the principle of the inclined plane and is found in the *screw* in all its various forms, in the *wedge,* in all *cutting tools,* and in the *horse power treadmill,* for sawing wood, cutting fodder, etc.

These two mechanical principles, together with two or three simple laws closely connected with the very existence of matter, lie at the foundation of all mechanism; that is, at the foundation of the means at our command for utilizing the forces of nature.

We naturally come, then, to a brief consideration of the various sources of power which nature has in store, and from which man must draw if he would produce effects otherwise than by the use of his own strength.

We first note the animal kingdom. Here, by domestication and training, a vast fund of power becomes available.

In the history of man this was naturally the first resource, and as far back as the glimmerings of ancient history can guide us, we find evidence that animals were domesticated, and their strength utilized.

The other great source, in fact, the principal source of modern times, is the energy given out when a carbon and oxygen chemically combine, in other words, when coal and wood are burned. The immediate product seems to be heat, and so it is, but by means of the steam or other engine, heat is readily transformed into work; and so by these steps we are enabled to use for our own purposes, a portion of the inconceivably vast amount of energy stored up in the coal mine.

Ages ago, how long or how many we cannot say, this energy was stored up for us by the sun in the vegetation which has since formed the material for our coal measures.

Here, then, is an enormous amount of energy ready and awaiting our use. The very highly concentrated form in which it exists in coal may be realized from the fact that if we could turn into work all the energy involved in one

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pound of coal, we should be able to raise 5,000 tons one foot in height or one ton about a mile high. If we used it in this way at the rate of one pound per minute, we should have power enough to run a 300 horse power engine.

It needs but little calculation to show that instead of this vast amount of power, we only obtain from 1-20 to 1-7 of it; or from 5 to 15 per cent; and for all purposes in which the farmer is interested, it is nearer the 5% than the 15%.

The cause of this great waste is beyond the scope of our subject this evening. Suffice it to say that the larger part of it is, in the very nature of things, unavoidable.

Granting, however, this great loss, there is still readily attainable enough coal and other carbon compounds to last the human race at its probable rate of consumption for possibly hundreds of years.

In passing it is interesting to note the fact that at present nature does not seem to be making coal as fast as man is consuming it; and that at some some day, far distant no doubt, but at some day the supply will begin to fall short. Just how the problem of life without coal will be solved is a very interesting question—more so to coming generations than to us—but at present it is difficult to see where any other readily available store of energy is to be found.

This is, however, of course, no argument against its existence, and perhaps close at hand.

Our great stores of energy are thus found in the animal and mineral kingdoms. The vegetable kingdom, of course, furnishes a large amount of carbon whose energy in relation to oxygen is turned into work; yet in comparison with the corresponding amount furnished by the mineral kingdom, it is insignificant.

The great office of the vegetable kingdom in this connection is to feed the animal kingdom as it in turn is fed and supported by a more or less direct intervention of animal life.

Having thus taken a broad view of the mission of mechanics, let us turn to some of its limitations.

It must first be understood that, although the farmer can call to his use the forces of nature, such use will by no means result in so much clear profit. Far from it. If men are employed, they must be fed and paid. If animals they must be fed and given protection. If wind or water power is used, the machine for utilizing it must be bought, with the certainty that after a time it will wear out and need replacing. If steam power is used, we must expend either wood or coal. That is, the men who have cut and hauled the wood, or those who have mined and brought the coal must have their pay; that is their share of the profits. There is then left to the farmer, simply the margin after thus paying for his aid. There will be, however, with fertility of the earth and proper direction, such a margin, greater or less in extent according to circumstances. This margin is the farmer's legitimate profit.

Secondly, it must be understood that we cannot in any manner obtain a given amount of work without using up an equivalent amount of energy. Doubt of this fact has given us in all ages seekers after perpetual motion. If we wish a certain effect from our steam engines, we must expect to burn up a certain corresponding amount of coal.

Similarly, if we ourselves and our domestic animals are to accomplish a certain amount of work, we must be fed with an adequate supply of food. Our capability of work, or that of a horse comes from the food eaten. An

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animal is simply a kind of engine and boiler combined, in which the energy inherent in the food is transformed into work. The direct result of this is, other things being equal, that the more work an animal does, the more food he needs; and that all useless work must be paid for in food consumed.

It may not come amiss to speak in this connection of another function of the food, viz., that of keeping up the animal heat. From this comes the advisability of warm shelter, food, and drink for stock during winter. An animal left exposed to the cold during the winter simply warms the chilling blasts as they blow over him at the expense of his owner's hay-mow and grain-bin. A moment's thought is sufficient to show that an animal exposed in this way constantly gives off heat which must be compensated for, either by an extra amount of food or by consuming the fat which he may have been able to lay on during the fall. Recent experiments in New York have shown that it pays well to give milch cows warm drink instead of cold. If it pays for cows, why not for other stock.

The practical application of this may be put in the form of a query.

Would it not pay to give in winter, as far as practicable, warm drink and food to stock, and provide them with warm comfortable quarters, paying, of course, proper attention to ventilation and exercise?

This reduces itself really to the question as to whether it is more profitable to supply the animal heat of stock through the winter entirely from hay, corn, and oats, or to obtain a portion of it from fire-wood, with a considerable probability of a solution in favor of the latter.

But to return to the main question. We have seen that energy, that is the capability of performing work, cannot be created. We can take, however, that which an Almighty Power has created and use it in all variety of forms, changing it now into one, now into another, as best suits our purpose. We may also vary the rate with reference to the time at which the energy is used. In more familiar language we may exchange speed for power and vice versa. This is a most important exchange, and we see it exemplified in the use of such tools as the crowbar, block and fall, stump puller, etc. This exchange, however, can bring us no addition of effect. In one form or another, the result is exactly equal to the cause. It is from the failure to understand this principle that some people have made the mistake of thinking that by the use of the block and fall, for instance, in raising a weight, they actually do less work than they would in lifting it directly, were such a thing within their strength.

As a matter of fact the use of the block and fall entails the performance of a little more work, since not only must the weight be raised, but the stiffness of the rope and the friction of the sheaves must be overcome also.

The block and fall, by exchanging speed for power, simply bring the performance of the work within man's capability. The work itself must be done just the same.

In the crowbar, stump puller and block and fall this exchange consists in purchasing power at the expense of speed. As other instances in which speed is purchased at the expense of power may be mentioned the *mower*, *reaper*, *thresher* and *saw-mill*, besides others which will occur to you unsuggested.

These fundamental principles and limitations are, of course, as applicable to manufacturing or other so called *mechanic arts* as to agriculture.

Let us now turn to some restrictions more especially pertaining to the application of mechanics to agriculture.

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In most of the branches of manufacturing it is possible by the use of improved machinery with skilled and properly correllated labor to increase many times the production from a given amount of capital over what could be produced without the advantages of the machinery and skilled labor.

While this is likewise true for the farmer, the relative increase is not so great. There are many disturbing elements entering into the question, as applied to the latter, which are present in a less degree in the case of the former.

Among these may be mentioned the vicissitudes of the weather, the uncertainties of good and bad bearing seasons, drouth, destruction of crops by insect pests, or of stock by contagious diseases.

The manufacturer also has his risks, many of them great; yet he is usually able to calculate with rather more certainty than the farmer the return from the investment of a given amount of capital.

Aside from this, most of the operations of agriculture from their very nature do not admit of reduction to the exact system of a machine. Take, as an instance, such a piece of mechanism as the Jacquard loom, which weaves the beautifully embroidered silken book marks, suspender webbing, etc. In this machine there are hundreds of co-ordinated movements, all so perfectly related that each at exactly the proper time produces its proper effect, and from this complicated maze of motion comes the fabric in all its beauty and symmetry of design.

Imagine, now, an attempt to reduce plowing to any such system. It needs little thought to show that such uncertain elements as variations in the soil, hidden roots, stones, alternation of side hill and level, etc., would render such an attempt practically impossible.

The same is true of nearly or quite all of our farming operations.

In very few, if any, can we set a machine at work which with little or no care from an attendant will run all day tilling our soil or gathering our crops.

But beyond, and perhaps of greater importance than these limiting elements, is the fact that nature herself steps in and objects to the forcing process. An acre of land will produce in a fair season say 20 bushels of wheat. A very favorable season and greater outlay in the way of fertilizers and preparation of the soil may bring this up to 40 or 50 bushels; but beyond some such maximum nature refuses to go, and no amount of extra labor will profitably better matters. If, then, more wheat is desired more soil must be laid under cultivation. This is not always possible, and where the question is reduced to getting the most from a given amount of land, it is plain that there is a maximum soon reached and beyond which we cannot expect that nature will allow us to go.

Another limitation we find in the large first cost of the various pieces of farm machinery.

Take the more expensive pieces of farming implements, such as the *mowing machine, horse hay rake, hay tedder, reaper and binder, grain drill, sulky plow, horse hay fork, engine boiler* and *plant for cutting green fodder*, etc. The farmer of abundant means may own these and as many more as he can find and thus derive what benefit he may from their use. To his neighbor of quite moderate means this will be impossible, and he will have to be content with such as he can afford the most suited to his individual needs. But the average farmer always has been and probably always will be, a man

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of comparatively moderate means, and this large first cost of machinery practically prevents its general introduction.

It should be the aim of our inventors and others interested in the application of mechanics to agriculture, not only to devise new machinery and new methods of work, but also to cheapen as much as possible by simplification and improved methods of shop practice, the present existing machinery so as to bring it within the means of the greatest possible number. Very much has been done in this direction within the last ten years, especially with the tools for harvesting hay and grain, and with some others; but the end should not be yet.

Sometimes nature imposes limitations where we should least expect them.

Take as an example, the desirability of a machine which will do the milking of the dairyman. In order to be an improvement over the method by hand, the machine must either do the milking faster than the man, or without his supervision, or, if possible, both.

This in the abstract seems to be perfectly feasible, but just at this point, nature, in the shape of the cow, steps in and objects to being milked after any such improved style, on penalty of various disorders of the lacteal system.

So while the matter is mechanically possible, the attempts in this direction seem to have, so far, failed to suit the conditions which nature has imposed; and here we are in 1888 A. D., milking our kine in the same way that they did in the time of Joseph or Abraham. So much for human progress in this direction.

Another element, by no means a necessary one, often decreases the good to be derived from the use of machinery.

This is its use in such a poor state of efficiency that far from the proper amount of benefit is received. Cutting tools, for instance, are used dull in order to save a little work at the grind-stone. Such time and work would, however, be tenfold repaid by the greater efficiency of the tools. The same remarks apply also to keeping machines and vehicles well oiled.

A pair of horses mowing with a dull set of knives in an improperly oiled machine have one-half more work to do than they should—if not more. When night comes, the horses are more tired than usual, and about one-half or two-thirds of the grass is down that should be. Instead of cutting that other third, the energy of the team has been expended in tearing off the two-thirds, and grinding down the journals and bearings of the machine one against the other. This of course must be paid for in hay and grain, the same as though it had been a useful effect.

We have thus briefly examined the principal limitations relating to the application of mechanics to agriculture.

With the exception of the last, they are inherent in the nature of things and can not be entirely removed.

The most that we can hope, is to reduce them to a minimum. The means to be taken to attain this end should then, it would seem, form a proper subject for the careful consideration and study of both the mechanic and the farmer.

Mr. Drew: One labor saving machine should be mentioned, the hay loader, to attach to the rear of a wagon. It will put on a ton of hay in three minutes, faster indeed than a hay fork will unload it.

Samuel McKee: What do they cost? I think there is a tendency to invest in too many machines. They necessarily stand idle most of the time, and the interest and wear and tear often overbalance the benefit. With one

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helper, a colored man now in my employ, I will load a ton of hay in three minutes.

Mr. Drew: My loader cost $45, and has lasted five years already. It has to be raked after but will, with two teams, put in twenty tons in an afternoon.

Mr. ———: What advantages has the sulky plow?

Mr. Reed: It accommodates the lazy man.

Mr. McKee: I can put a bit of a boy on a sulky plow and he can go out and do perfect work all day without being used up in the evening, but can do his chores easily. My land is smooth and not stony; also he will do one-half more work than he can with the walking plow. As an average with the same team I get one-third more work done with the sulky than with the walking plow. I use the "Solid Comfort."

Mr. Morrice: I agree in every respect with the last speaker. I was prejudiced against it and only took it on the urgency of the agent who set it up in my absence on a stiff clover sod which I had half plowed with a steel plow with three horses. My man said it worked easier and did the work better. Next day we tried the two side by side with the same result. I find that a boy can do good work and do as much as the team is good for, and think I can with the same team do one-third more with 14 inch sulky than with 14 inch walking plow. I use the Cassady. My land is perfectly free from stones.

Mr. Kimerly: I wore out a Cassady on stony land, and had to use three horses. I wouldn't take another as a gift.

Mr. McKee: I had the Solid Comfort and the Cassady side by side, an liked the former the best, and it ran from 75 to 100 pounds easier than the other. The Cassady is hung on two wheels and is susceptible of motion sideways. The team works as easy as with a walking plow. There is no tongue to it. I have no large stones on my place.

Mr. Morrice: I used to like a riding cultivator because I could control team easier and manage the plows with my feet, and think I could do better work than with a walking cultivator. I have known a sixteen-year-old boy to cultivate corn well with a rider.

Mr. Barber: Riding is nice if you cultivate your own corn. Hirelings are apt to be too careless to do good work on the riding cultivator.

Mr. Wiley: The fence corners around here are full of abandoned sulky plows.

Mr. W. W. Reynolds: A sulky plow can't turn a corner nor remedy a balk, and an acre plowed with the walking plow will raise 10 to 25% more wheat than if plowed by a sulky plow.

Mr. Hadsell: For small farms I consider sulky plows a useless luxury.

CONSTRUCTION OF DRAINS.

[BY PROF. R. C. CARPENTER.]

Drains are often constructed in such a way that what should be a permanent benefit, is only a temporary relief. If tiles are laid they soon choke up, or are washed out of position, and prove entirely inadequate to the work. For this work you will find that you seldom can trust to men who claim to have had experience, especially if that experience has been gained in the "Ould Country." In the first place, the method of draining practiced in

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England until very recently is different from that here. The practice there has been to use a great number of drains placed very close together, in which are laid very small tile.

The trenching or digging over the soil is considered of great benefit in that country, and of no benefit whatever in this. Again, the work there is generally under the supervision of engineers and in reality the experience gained by the workmen relates entirely to the handling of the shovel and nothing more.

If you want a good job of draining done, you must at least understand how to do the work yourself.

The construction of the open drain I shall not discuss, although it often plays an important part in any system of drainage. The sides of the open drain are usually sloped at an angle of 45 degrees, or one foot rise to one foot horizontally; they would be much more permanent if made with a less slope. A rounded form will stand better than one with abrupt angles. The earth should be well thrown back from the edges.

POINTS OF CONSTRUCTION.

In the construction of any system of drains, the first consideration should be given to the total amount of land to be drained, then the outlet should be determined, next find the best location for the main drain, which is generally near the natural drainage of the tract in question. It is an important point to have it direct as possible, as every turn lessens the amount of water that will pass through the drain.

You must then determine the amount of fall that you can get for your drain.

You are then ready for the construction of the drain. This involves the digging, the laying of the tile or other material for underdrainage, and the filling.

HOW TO DETERMINE THE FALL OF THE DRAIN.

Farmers usually measure distances in rods and small amounts of elevation in inches, while they are accustomed to express the fall as a certain number of inches in a rod. Engineers, on the other hand, are accustomed to keep everything in feet and decimals of a foot, and to express the fall as a certain number of feet in 100 feet. This makes a reduction necessary in order to put the two systems so that they may be understood by each.

The following table shows the relation of these two systems:

Fall in inches per rod.	Fall in feet per 100 feet.
1	0.5050
2	1.0101
3	1.5151
4	2.0202
5	2.5252
6	3.0303
7	3.535
8	4.040
9	4.545
10	5.050
11	5.555
12	6.060

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For the purpose of determining the fall we must have some means of securing a level or horizontal line. This may be obtained by a plumb bob in an approximate way, but much better by a spirit level. A carpenter's square suspended in a split in the top of a stake with a plumb bob hung at its inner edge when the vertical arm is parallel with the string of the plumb bob, the other arm is horizontal and may be used to sight over. A small hole can be bored without injury to the square on its inner angle,from which the string may be suspended. This method will not be very accurate, as the plumb bob is likely to swing back and forth or to deviate from its proper place because of the wind. If the bob is in a dish of water, it will give better results. If there is a decided fall the method with the plumb bob will be sufficiently accurate.

A good spirit level can be obtained for a small price, the accuracy of which can always be tested by setting the level on a piece of board, then moving the board until the bubble comes to the center; then with the board fixed turn the level end for end. If the bubble still remains in the center the level is correct, if not, it may be corrected by adjusting screws which are on the level.

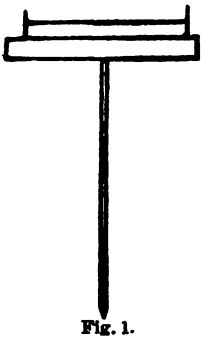

Fig. 1.

To obtain a horizontal line with a spirit level, set the level on a T stake as in Fig. 1 and then crowd the stake over until the level is in the desired position. If sights can be put on the level a much more accurate line can be run.

In both the preceding cases the sight line will be horizontal. To obtain the fall, then, we must have a graduated stick or rod to hold at the places where the level is wanted. The distance that the bottom of the rod resting on the ground is below the sight line gives the height of the line of sights above that point on the ground. The difference between two such rod readings would be the fall beween two points.

PROPORTIONING SIZE OF TILE.

After the grade has been determined the size of the tile can readily be calculated, provided we know the amount of water to be taken off. This amount is not known with certainty, but a tile drain must be able to carry off the water from a reasonably heavy rain at once, else it will fail to be of any service in a wet season and may as well not have been built. This water must be taken off, too, before the crops are injured. If drains have a capacity capable of taking off one-half inch in depth of water each day of 24 hours they seem to answer all requirements in this State; it is certain that much smaller drains often fail. It is quite certain that long main drains may be made much smaller, from the fact that the water occupies more time in reaching it as compared with a short one.

The following formula gives the discharge of drains in cubic feet and is fairly accurate for smooth and well laid drains:

APPROXIMATE FORMULA:

$$A=3.8\sqrt{D^5h}$$

A=acres drained.
D=diameter of tile in inches.
h=rise.
l=length.

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WATER TO BE REMOVED.

The capacity of the tile must be made dependent under this consideration and this varies in somewhat wide limits. If the rainfall is the only factor involved, the difference in different localities is not as great as one would on first suggestion suspect; the variation is probably in no case as great as the variation in the annual rainfall. In case of water from other sources, just so much additional capacity must be given to the drains. The annual rainfall is of very little importance in this consideration from the fact that our drains to be of service must be able to remove the excess of water much oftener than once per year. Suppose the annual rainfall to be about 36 inches, or one-tenth of an inch per day; if, then, the capacity of our drains were sufficient to remove this water it might be thought that we should get good results. This would increase the capacity given in the table five times. I have known systems of drains to be put in on this plan, and although the investment was small for large areas, still so far as any returns were concerned, it was thrown away. Agricultural crops do not flourish unless the water can be removed within a certain definite time after it falls. That period varies for different crops and under different systems of cultivation, but my observation leads me to believe it is not profitable to have this period longer than twenty-four hours.

As to the smallest size of tile I care to say but little. Tilemakers are doing all they can to discourage the use of tile smaller than three inches in diameter, because they find that frequent failures result from using the smaller sizes. The failure of the small size to keep open is due principally to the poor manner in which they are usually laid. A small irregularity reduces the size of opening proportionally much more than in large tile and destroys the current flowing through it; the result is that small tile often fill up, when large tile make no trouble at all. If tile smaller than three inches are used, great care should be taken in laying them. When well laid, however, they are no more likely to make trouble than larger ones.

METHOD OF LAYING TILE TO GRADE.

If the grade of the drain is known, so that the size of the tile can be selected, or if you can ascertain that there is a fall and decide on the size of tile some other way, the following method may be used as a substitute for any method of leveling.

I would always advise its use for construction whether the drain has been previously leveled or not. At the outlet of the drain, drive a stake each side and fasten from stake to stake, a horizontal cross bar any convenient height above the bottom of the ditch. This cross bar may be nailed to the stakes held by clamps, but it should be leveled. At the point where the grade is to change (even though it may be at the upper end of the drain), fix another cross bar in the same manner and at the same height above the bottom of the ditch. Now sight from one cross bar to the other and have a series of similar cross bars set. They can be got in exact line with the first two by sighting. Permanent ones should be as close as once in twenty rods, while temporary ones should be set in advance of tile, laying as close as once in three rods. Stretch a line from stake to stake, and it is evident at once that such a line is parallel to the required bottom of the ditch, and by having a pole the proper length, the ditch can be dug as accurately as wanted.

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This method may be thought cumbrous and worrisome to carry out. As a matter of fact there is very little work to it, two men can lay out in half a day all the work that can be done in two weeks, and lay it out with such certainty that no question will ever arise as to which end is higher.

The method of leveling with running water is no method at all, although if the ditch can be opened its whole length and will stand the wash without injury it is a comparatively safe method. You can not in that way secure a uniform grade. The system described is so systematic that the drain may be opened and tile laid and drain filled in any part, irrespective of the rest of the drain, and yet be absolutely certain of securing a perfect grade.

If you will only try it I will guarantee that no matter who may do your digging, you will look out for the laying of your own tile.

THE EXCAVATING.

The excavating, or, as commonly called, the digging, is, for small tile, usually the most expensive portion of the work. The occupation of ditching is usually considered a very bad one, and for that reason it is generally well paid as compared with other labor. The ditchers are usually paid about the same rates as prevail for harvest hands when they are much needed. I do not make the claim that it is easy work to throw dirt out of a ditch, neither do I wish to convey the impression that skill is not necessary, for as a matter of fact, the skilled workman will frequently do more than double the work of the unskilled man and apparently with less exertion too. The best ditcher is not always the heaviest, or strongest man, neither is he likely to be the man who does the most work with his mouth, and he certainly is not the man who under the plea of having gained experience in the "ould counthry" will not dig a straight ditch or do the work as you wish it done. Very many machines have been invented for the purpose of doing this generally detested work of ditching, yet although quite a number have been sold and are apparently doing good work, still they are far from being in general use.

The work of ditching may be accelerated and made much lighter very often, by turning out of the place for the ditch, several furrows and softening up the earth as deep down as possible with the plow. Very often fully one-half difference is made in the labor by this process. Ditchers generally do not approve of this, because it breaks up the edges of the ditch and they cannot make an artistic looking job—and it also lessens the number of days' labor on the ditch. As the ditch is to be filled as soon as constructed, the objection is one of no weight at all. In case plowing is to be done, stakes for the cross bars should not be set until after the plowing is completed. When horses can be worked the filling can be done very cheaply with the plow and the ordinary scraper, or better still with a scraper of the form shown in Fig. 2.

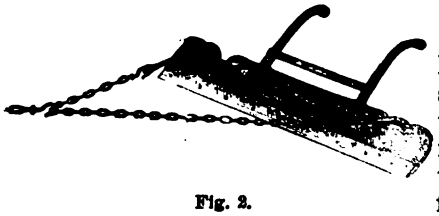

Fig. 2.

The width of the ditch, in all cases, should be the least possible, in order to lessen the amount of earth removed and also because it affords a snugger bed for the tile. This last is a very important matter when we consider the liability of the tiles to be crowded sideways in filling.

A simple machine or plow that would remove the earth for two feet in

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depth and merely loosen up the earth for the remaining depth, would lighten the labor of ditching very much and would be comparatively inexpensive. This would leave quite a good deal to be done by hand, but nevertheless it would lighten the drudgery, and it would seem that such machines might be afforded in every neighborhood. The present machines are, of necessity, costly, and there are few townships in our own State that have work sufficient to make them pay. The financial question is in this case as important as the mechanical one.

CONSTRUCTION OF THE DRAIN—STONE DRAINS.

Small rounded stones two to four inches in diameter, thrown promiscuously in the ditch to a depth of eight to twelve inches, and covered with a layer of straw, or better still, marsh hay, make a very efficient and a very durable drain in soil reasonably firm. I know of a drain constructed as described twenty-one years ago, that is in efficient working condition to-day. For drains conveying a small amount of water I believe such a construction to be equal to, or better than tile. It will not work in sand.

TILE DRAINS.

I prefer cylindrical or round tile to all others, although there is no special objection to tile with an octagonal shape outside if round inside, neither is there any special virtue in these tile, and they are more expensive to manufacture. The round tile hold their place in a ditch fully as well as the others. All tile should be well burned, and made of a material that will not decompose or crack when subjected to the action of water. It is also important, especially in main water courses, to have the tile perfect in shape. Mis-shapen or culled tile are dear at any price.

I shall refer to a few points to be carefully watched in construction and then will abruptly close my paper.

1st. An outlet structure that will effectually hold the earth from falling over the tile is very important.

2d. It is never necessary to use boards under tiles in draining, if the tiles will sink into the earth without boards, they will also sink with boards. If the whole line sinks equally no harm is done. A soft spot in the bottom should be filled with gravel or firm earth.

3d. Covering of joints is not essential in clay or in very hard ground, but in soft soils they should be covered. For this purpose a piece of turf, grass side down, tarred paper, or marsh hay is good.

4th. It is a good plan to lay tile from the bank, with a pin placed in a stick. When it is necessary to cover the joints of the tile keep a foot or two of earth on them, then stand on the tiles and reach over to lay tile and also to cover the joints.

Do not walk on the bottom after it is ready for the tile.

6th. Test every tile after laying by measuring from the line over the ditch. The line should be about three feet above the bank, in order to be out of the way.

7th. Tile may be laid in quicksand and muck in the usual way. Especial care is required in such soils. Tile are more likely to rise above the grade line than to be crowded below in such soils.

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Tile should be laid end to end, fitting as snugly as possible—the water will get in.

A. L. Drew, of Berrien county, said a silt basin was a very desirable thing to arrange in front of the tile drain where an open drain is discharged into it. He also recommended a machine by the use of which with four horses he could make 400 rods a day of open drain, 12 inches deep, and the machine was an excellent road maker.

Prof. Beal: What are the objections to digging the ditch the whole length and testing the bottom by flowing water through it?

Prof. Carpenter: It is expensive, and by the time you get to the outlet the water probably won't flow. The fall cannot be accurately tested that way.

Prof. Willits: Is there any danger of draining land too much?

Prof. Carpenter: That has been satisfactorily tested during the past year. Prof. Wood, of the University, went over the rainfall statistics for last 50 years, and found that drouths have occurred early in the period as severe as have been experienced lately since drains were laid, and that drouths cannot be attributed to drainage. Drainage may dry up wells, but such wells ought to be dried up, as they are filled with surface water. Ordinarily the only cases of over draining are in peaty soils.

Mr. ———: What is the best depth for tile drains?

Prof. Carpenter: The depth varies greatly, usually between three and four feet. Get below frost line, and that here is about three feet.

GENERAL FARMING.

[BY HON. C. H. MORSE, OF NEW HAVEN.]

[Read at the Ithaca Institute, February 3, 1888.]

Mr. Chairman, Ladies and Gentlemen:—I came to Gratiot in November, 1867, and then had the idea that wheat was our staple product by means of which we were to raise cash, and that spring crops, stock, etc., were valuable only as we had use for them on the farm, and that it was desirable to conduct our business so that a minimum amount of these would be needed.

The yield of wheat on an average was lamentably small. For years wheat commanded a good price, and because of that many did succeed fairly well in raising it as a specialty.

In these days, however, of small prices the question is, how shall we have the most produce to market, and what will bring the most profit?

Wheat alone while always bringing spot cash at some price will not do as a specialty; for our soil, while as good as the best, will wear out, and we must diversify the business as the only practicable way of keeping our land fertile. It is just as possible to starve land as it is to starve cattle.

I know of no better way to keep our farms in condition than by a judicious system of rotation of crops, for with such a system must come the keeping of stock, and while stock alone will not be found profitable on the average Gratiot farm, yet taken with grain raising they will do their part toward "increasing the surplus," which, however much it may trouble President Cleveland, is never a source of uneasiness to the farmer. I shall not attempt to prescribe just what rotation it is desirable to follow—that depends more or less upon the peculiarities of the soil in different farms.

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The seasons, whether wet or dry, after causing a loss of "a catch" in seeding will frequently break into a rotation and compel a radical departure from any plan which may be devised.

I only venture to suggest this: our fields should lie in grass, clover largely, at least half the time. No one need expect a good catch of clover or timothy among June grass or weeds. A judicious use of plaster and salt, both having a tendency to retain moisture in the land, will be found a paying investment. On my farm from fifty to seventy cents an acre invested in salt and plaster have increased the value of my hay crop and pasture an average of five dollars an acre, and no combinations which the salt or plaster men can make to put up the price will make me cease to use them.

I do not believe we can afford to let our fields lie idle, consequently I would not summer fallow a field unless it was necessary to do some particular work on that field which could not otherwise be done. Ordinarily I would not mow a field more than twice and pasture it one year at a time. I want the benefit of the clover roots while they are at their best. I would plant corn on a clover sod invariably but for the cut-worm. As a rule I have been better satisfied to sow wheat after a meadow, turning it over as soon as possible after haying, following with corn after wheat, oats following the corn. I sometimes seed down with this oat crop and sometimes follow the oats with wheat and then seed down, being controlled in this by the amount of manure I am able to put on the field.

Every farmer of ordinary intelligence can arrange a fairly good rotation of his crops and personal experience will be better than any rule anybody can give him. It will readily be seen that stock is a necessity in any rotation. Most farmers can winter more stock than they can summer. This would not be so if it were not a general rule to pasture only those fields which are the poorest.

No stock is more beneficial than sheep. As scavengers they are unequaled. No fence corners will grow up to weeds and briers if sheep are allowed to get at them, and generally they seem to fit into corners on the farm which would otherwise be unoccupied.

I want to impress on the minds of all one thing in reference to all stock. Keep good stock. If unable to keep good sires a dollar more or less should not prevent the use of good sires if owned by neighbors It has cost me as much to raise and fatten a native steer that would bring me forty dollars at three years old as a grade shorthorn that at the same age would bring sixty dollars. It is poor policy to sell stock in poor condition. The home market for all coarse grains and coarse feed is the best. It is better to feed out the coarse feed and drive it to market than to draw it over bad roads and sell lean animals.

Too many farmers are as smart as the darkey said his master was. He said "his master was powerful smart—make money twice in one year. First, he sell all the hay and grain he raised in the fall and made money once. Next he sold all the hides from the stock that died for want of that hay and grain and made money twice."

By following a diversified system of farming there will be no month in the year that something may not be sold, and with cash coming in almost daily, even though it be in small amounts, there will be no necessity for a tick business with the tradesman, and spot cash will buy goods cheaper than any man's tick system.

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HOW TO MAKE THE FARM PAY.

[BY SILAS MOODY OF FOREST HILL.]

[Read at the Ithaca Institute, February 3, 1888.

My subject is how to make the farm pay, and my first answer is, by not cheating the farm. Too much wheat is raised. Many men sow wheat after wheat, and get about half a crop the second time. The properties necessary for wheat soon become exhausted, and it will cost money to replace them, for in my judgment it is mixed farming that pays best. This year those who raised hogs received good pay; but it won't pay to raise all hogs. But it will pay to raise fewer in number and better quality.

If I were to raise but three calves, I would have them from a thoroughbred sire, and feed to them what is often fed to five. To get the best results in feeding stock keep the animal growing constantly during the first year of his life. Any neglect that will stunt the animal during this time cannot be made up for later. Like the fleece of wool upon a sheep's back, if you starve them a short time only and think to make up by feeding better, you will find at time of shearing a weak place in the wool that will justly dock you on the price.

If you want to make a smooth shiny horn upon your steers keep them growing as rapidly as possible, and you are sure to get your pay at time of selling, for the experienced buyer knows at a glance how they have been kept.

Native stock is unprofitable, grades or pure bred stock will pay at least a third better. Don't sell anything off the farm that can be fed on the farm.

WHAT IT COSTS TO RAISE CROPS.

[BY INMAN COWDRY.]

[Read at Ithaca Institute.]

There are very few farmers indeed, who have any idea what a bushel of any of their crops costs them.

They raise their crops and sell them, year after year, not knowing whether they are making or losing. I can tell in a minute's time, to a fraction of a cent, what a bushel of anything costs me as soon as I know the yield. For the benefit of those who are interested I will read the forms that I have adopted, commencing with wheat. We will start out with a ten-acre field:

WHEAT, DR.

To five days' plowing, $2.50	$12 50
three days' dragging, $2.50	7 50
two " rolling "	5 00
15 bu. seed, 75c	11 25
one day's drilling	3 00
rent of land at $5 per acre	50 00
cutting and shocking	15 00

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To drawing and stacking	$6 00
threshing 200 bu., 8c	16 00
marketing, 2c	4 00
Cost of crop	$130 2

WHEAT, CR.

By 200 bu wheat, 80c	$160 00
10 acres straw	10 00
Total credit	$170 00
	130 25
Profit	$39 75
Cost per bushel	65
Percent of profit over cost of production	30
Percent on capital invested	08
Profit per acre	$3 97
Cost per acre	13 02

We will suppose wheat to have been sown on oat stubble ground. You will observe I have given plenty of work to make the ground in excellent shape, and that I have allowed a good price for all necessary work in securing the crop. You will also observe that you can sit in your chair, hire all your work done, and if you can get 20 bushels per acre you will still make 8 % on your money, counting your land worth $50 per acre. So you see wheat can be raised for present prices.

Now we will take oats, and suppose them to be sown on corn stubble ground, and in the very best of shape, because it don't pay to put a crop out in any other way. You will always get well paid for any reasonable amount of extra labor in preparing your seed bed. In the first place you should have your field well plowed, then you can get it level much easier. One-half day's extra time in plowing 10 acres will do a good job. Then the drag will take hold all the time and not be bobbing over bumps and filling hop balks all the time. What time you lose plowing you will make up three times in dragging. We will now start out with ten acres of oats.

OATS, DR.

To five days' plowing, $2.50	$12 50
two " dragging, "	5 00
two " rolling, "	5 00
twenty bushels seed, 35 cents	7 00
one day drilling	3 00
rent of land at $5.00 per acre	50 00
cutting and shocking	15 00
drawing and stacking	5 00
threshing 500 bushels, 4 cents	20 00
marketing 500 bushels	8 00
Total cost of crop	$130 50

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OATS, CR.

By 500 bushels oats, 35 cents	$175 00
10 acres straw	15 00
Total credit	$190 00
	130 50
Profit	$59 50
Cost per bushel	$0.261
Per cent. of profit over cost of production	.44
Per cent. on capital invested	.109
Profit per acre	5.95
Cost per acre	13.05

I find that oats are the closest crop that I can raise. You have the least margin to go on. But at the present prices it is more profitable than wheat. At 35 cents there is a good square profit. I have put the yield of oats at 50 bushels per acre. Some will say that that is altogether too high. But every farmer can easily average that much if he puts his crop in right, on carefully prepared ground. Oats costs a trifle over 26 cents a bushel to raise and market them; so you see a man can't get rich very fast selling for 20 and 25 cents a bushel.

You scarcely get paid for your labor. One thing, however, is in favor of oats. It is a quick crop and you have the use of your money sooner, besides you have quite a good chance for wheat after them. Oats should never be sold from the farm for less than thirty cents a bushel; they should be ground with corn and fed to stock, and sold in that way. We will now pass to the best crop of all, the crop that has dethroned old "king cotton," and now sits on his throne and boldly declares, "I am king"—corn.

I have often asked farmers, which is the best crop to raise; scarcely one of them would say corn. The majority would say oats, when in fact it is the closest.

We will now plant a field of 10 acres of corn. Plow the ground well, fit it well, plant it well, and cultivate it five times through, and trust to nature for the rest in giving you 100 bushels ears per acre.

CORN, DR.

To 6 days' plowing, $2.50	$15 00
3 days' dragging, "	7 50
1 " marking	2 00
½ bushel seed	1 50
3 days' planting	3 75
1 " dragging	2 50
15 " cultivating	30 00
cutting and shocking	10 00
husking and cribbing	40 00
rent on land $5 per acre	50 00
Total cost of crop	$162 25

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CORN, OR.

By 1,000 bushels corn	$250 00
10 acres fodder	50 00
Total credit	$300 00
	162 25
Profit on crop	$137 75
Cost per bushel	$0.162
Per cent of profit over cost of production	.849
Per cent on capital invested	.324
Profit per acre	13.77
Cost per acre	16.22

You will see that I have given plenty of work to raise good crop if nature only performs her part. I have counted 100 bushels per acre, which some may think too large; but it can be raised one year with another if properly done.

COMPARATIVE FIGURES.

	Cost per Acre.	Cost per Bushel.	Per Cent of Profit over Cost of Production.	Per Cent of Profit on Capital Invested.	Profit per Acre.
Wheat	$13 02	$0.650	30	8	$3 97
Oats	13 05	.261	44	10.9	5 95
Corn	16 02	.162	84.9	32.4	13 77

You see by the above comparison that corn is altogether the best crop to raise, even at 25 cents per bushel.

You can drop considerably from 100 bushels per acre and then beat either wheat or oats. I will leave it for you to decide why people don't get rich with such profits.

Prest. Willits: Have you made any estimate for manure?

Mr. Cowdry: I had thought of this, but manure is drawn during the winter when time is plenty, and as the effect of manure lasts four years, the expense for one year would not be great.

Prest. Willits: The Secretary of State has prepared some figures regarding the cost of raising wheat. Gov. Luce does not agree with them. He thinks they have not taken enough into account.

Mr. Morse: I don't think the reports (wheat) from Secretary of State are wholly reliable. Farmers are inclined at harvest time if crop does not pan out well to shrink the acreage.

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ANOTHER VIEW.

HOW MUCH IT COSTS TO RAISE CROPS.

[BY R. A. PEET OF LA FAYETTTE.]

[Read at the Ithaca Institute.]

Eighty acres of land, 70 improved, buildings up, cost...	$4,000 00
Cost of team, $300; harness, $30; wagon, $60; plow, $15; drag, $20; binder, $150; mower, $50; rake, $25; corn plow, $3; forks, rakes, axes, $5; drill, $50; roller, $20; fanning mill, $15; 25 bags, $5; sleighs, $30; whiffletrees, $5; twine, $10; costs for repairs one year, $25.	818 00
Total	$4,818 00
Interest and taxes one year at 10 per cent	481 80
Implements on farm totally wear out in 10 years	80 00
Farmer for 300 days' work, $1 per day	300 00
Total cost of farm one year	$861 80
Credit to farm 20 acres wheat, 15 bush. beside seed, 70c. per bush	210 00
Credit to farm 20 acres oats, 37 bush. beside seed, 25c. per bush	185 00
Credit to farm 20 acres grass, 20 ton, $8 per ton	160 00
Credit to farm 10 acres corn, 70 bu. per acre, 25c. per bu.	187 50
Total amount of crops harvested	$742 50
Loss to farmer of	119 30
And the threshing bill, cash	29 60
Total loss	$148 90

There is a failure of crops once in ten years, and a wet season to ruin the wheat crop about once in 10 years. Brothers grangers, are you surprised that five-eighths of the farms are under mortgage?

Mr. Winton: We have had two pictures presented this morning, one that farming does pay, another that it does not. Is it not in the *man*? There is a small margin in his favor. If the margin is saved we have the first picture, if it is squandered we have the second. The secret of success is good farming, treating your farm squarely, paying back to the soil what has been taken from it.

Pres. Willits: Mr. Peet has said farms are mortgaged. Well, what enterprises are not mortgaged? Every railroad certainly is. Now I have been a lawyer and I know what mortgages are drawn up for. They do not mean loss, usually they mean an improvement. A farmer wants a house and other comforts; it will take him ten years to make these on the profits of his farm.

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He mortgages the future and has the comforts at once, for which he pays the interest. Whether it becomes loss or not depends on the man and his ability to save, and on the woman too.

Mr. E. H. Stow: I know of 80 acres near here, that has *netted* $600 above all expenses of farm and living of family in a year.

W. W. Comstock: Farming will pay if it is properly done, if not properly it will *not* pay.

Mr. Cowdry: Some may have the impression that I sold the straw from the farm; not so, I merely took credit for it, supposing it to be used up on the farm.

INDIAN WHEAT.

[BY ELIAS MORRIS OF VOLINIA.]

[Read at Cassopolis Institute, February 13, 1888.]

Wheat has for many years been the main reliance of farmers as a money crop, and notwithstanding its low price, both at home and abroad, they are reluctant to lessen its production, trusting and hoping that something may happen that will enhance the price. Such hope is vain and delusive; the law of supply and demand always governs the price of farm products, as well as other things. The low price is not due to any falling off in consumption, but to increased production on account of opening new territory specially adapted to its culture, both in this country and abroad. The relief must come either by increasing consumption, or lessening the production, or cheapening the cost of production. The remedy must be sought in the latter direction; by more intense farming, by producing on one acre what has formerly grown on two; by the aid of the most approved labor saving farm implements. The price of labor always cuts an important figure; it is neither desirable nor expected that laborers will be compelled to accept the pauper wages of Europe. We must expect that the price of labor in this country will in the future, as in the past, continue to be governed by the demand and supply. India is our most formidable competitor in wheat raising in the world. It has 68,000,000 of acres adapted to wheat raising; the crops of the hottest and the coldest countries can be grown there; there is not a month in which the farmer may not work in his fields; his implements are rude and inexpensive, the entire outfit consisting of a pair of oxen, valued at $8; plow, 40c.; yoke, 15c.; leveler, 30c.; weeder, 6c.; winnowing scoop, 6c.; sickle, 6c.; water lifter, 50c.; a total of $9.33. The price of agricultural labor is about 7 cents per day; wheat from that country cost in 1885 delivered in London about $1.00 per bushel. India, with five times the population of the United States, with 68,000,000 acres adapted to wheat raising, and with the advantages of cheap labor, only lacks the intelligent application of improved labor saving implements to surpass the American farmer in the cheap production of wheat.

The speaker made an exhaustive comparison of wheat producing countries, and concluded that India had come into the wheat business to stay, and that wheat exports from this country, in the future, would have to compete with that product in price.

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CORN.

[BY P. B. COWLEY, ITHACA.]

This is the most valuable of all our grain crops. It is of American origin, and according to history was not introduced into the old world until after the discovery of the new. It is estimated that it is eaten by a greater number of human beings than any other grain (except rice), and its analysis shows it to be admirably adopted to sustain life, and to furnish materials for the growth of both man and domestic animals. It is largely grown in the United States, but principally in the States of Illinois, Ohio, Indiana, Iowa, Missouri and Kansas, and our own State of Michigan furnishes its quota in proportion to other States which do not make this their principal crop. For this particular locality I do not advocate the raising of it in large quantities. If our farmers were to try it more generally, and raise a small quantity each year, thus by experimenting with the different varieties, we could in a very short time ascertain which variety would be best adapted to our soil and climate, and by that way would be enabled at least to grow enough for home consumption. I have successfully grown the following varieties, viz: Early Compton, White Flint, and what is called the Early Red Blaze. Of these three varieties I would recommend the Early Red Blaze. It is not only early but will endure, uninjured, a degree of cold and wet that would be fatal to other sorts. I have raised more bushels to the acre of the Early Compton, but don't think that one year with another it is as sure to ripen here as the Early Red Blaze. Of the Early Compton variety I have raised ninety bushels of ears to the acre, of the Early Red Blaze about seventy-five. I usually plant from the 16th to the 20th of May, and I would recommend a rich, warm, alluvial soil, and immediately before planting this should be as deeply and thoroughly worked as possible. Plant in rows about three feet three inches apart each way, planting from five to seven kernels in a hill which requires about ten quarts per acre. To guard against crows and blackbirds pulling out the seed I would recommend rolling the seed before planting in plaster with a little tar mixed with it, and for light soils I recommend the use of a small quantity of bonedust or superphosphate as a fertilizer, a teaspoonful dropped in each hill before planting. As soon as the corn is up so that the rows can be easily distinguished I go through the field with a cultivator, and afterwards when the plants or stalks are about a foot high I go through again with a shovel plow, throwing the dirt up to the corn, then go through it and hoe it, hilling it up. I do not recommend making too large a hill, only drawing sufficient earth up around the plants to support them and keep them from blowing over or breaking off with strong winds. Thorough cultivating and warm, rich soil are the keys to success. I estimate the expense of growing corn at about $15.00 per acre, and with an average crop of seventy-five bushels of ears to the acre, worth thirty cents per bushel, which will equal $22.50, to which add the value of the cornstalks for feed, $5.00 per acre, making a total of $27.50 per acre, thus leaving a profit of $12 50 per acre; besides, ground upon which corn has been grown and properly cultivated is generally left in better shape and condition than after any other crop. Thus it may be and has been truthfully said that "Corn is king."

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SILO AND ENSILAGE.

[BY E. J. COOK OF OWOSSO.]

[Read at Owosso Institute, Jan'y 31, 1883.]

We are here as a company of farmers, to consider and discuss practical questions in regard to our profession and the best means of advancing our interests, and to determine as far as possible, how we shall most effectually make our efforts and investments pay the largest dividends.

The topic before us, Silo and Ensilage, is opportune,—a live question of the day. Hundreds of intelligent and progressive stock raisers, not only in America but in Europe, have been experimenting for several years and have proven by actual test that corn, as well as other fodder, can be cut when in the best condition and put into an air tight receptacle and preserved until wanted for use quite as well as our small fruits. They have found that the advantage gained is not alone in the great superiority of the food over that which is dried and secured in the ordinary manner, but that it can be done with much less labor, and more stored in a given space. These men tell us that with their silos they can keep twice the amount of stock, in better condition on the same farm than they could when they cured the fodder and fed it dry; that it is unequaled by any food they have ever fed in keeping their stock in perfect health and fine condition. They tell us that they can raise from eight to forty tons of ensilage corn to the acre, and the whole expense of raising and putting into the silo, including interest on the value of the land, need not exceed $1.50 a ton.

In 1880 there were six silos in the United States, while in a recent number of the *Country Gentleman* it is stated that there were built in the State of Wisconsin alone more than one thousand silos during the past year. And the managers of these silos are leading representative men—many of whom were doubters of the practicability of the silo; but when they came to test the matter by experience they became strong advocates.

But we want facts derived from actual experience and not the reports of rich enthusiasts who are experimenting with the money someone else has earned, or their fathers have left them. I think because I had a little experience in building and filling a silo last season and feeding the ensilage this winter, I was assigned this topic. I am convinced that fodder can be preserved in this way if air and water are excluded, which can easily be done. My ensilage is eaten eagerly by all kinds of stock, and without any waste. It has been remarked to me that it must be unhandy and unpleasant to handle, but on the contrary, it is especially convenient and quite agreeable to feed. There is very little odor from it and that is pleasant rather than otherwise.

The corn crop is the most difficult to secure in a satisfactory manner of any that we raise, but it is especially adapted to ensilage, because of its easy and rapid growth, its immense yield per acre, and the greater certainty of a good crop in unfavorable seasons if properly managed. It contains, when siloed at the proper time, the elements of a perfect stock ration in a greater degree than any other single winter food at our command.

Our corn was not the kind generally recommended for the silo, it being of a smaller variety, and though good last year, considering the season, the

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yield was only about eight tons per acre. I was pleased and greatly surprised at the dispatch with which it was put into the silo. Six men put in 43 tons in three days, and the field was over a third of a mile from the barn. Two acres were secured in this way with no more expense than one acre from the same field, husked and managed as formerly, and it is superior feed.

Prof. E. W. Stewart, in the *Country Gentleman*, speaking of ensilage as food for stock, says: "It is *more* complete than a crop of *good corn* that has been harvested, corn ground into meal, the stalks run through a cutter, and the ground grain mixed with the cut stalks, because the ensilage is in a succulent condition and much more digestible." This is in accordance with my observation. The corn all went into the silo with the stalks but we rarely see any in the manure. Cattle, horses and sheep which were fed dry cornstalks in the morning wet and mixed with meal composed of equal parts of corn and oats, good timothy hay at noon and ensilage at night, all showed a marked preference for ensilage.

After we had fed in this way about four weeks, we took a two-year-old grade heifer of the herd for experiment. She was giving milk and receiving four quarts of meal a day, fed as above. She was then fed ensilage alone three times a day, just what she could eat at once, clean. She has gained by actual weight one and one-fourth pounds, and her calf two and one-fourth pounds, daily, since the change. Still I am watching them closely, for analysis shows that ensilage corn is not a perfect stock ration, that it lacks in muscle and bone growing material. We do not always want the same bill of fare, so science and analogy teach us that a *variety* in food will best maintain the health and condition of our stock, but I am convinced that the large portion of that food, both for convenience and profit, should be corn ensilage.

The silo is about 14 feet square, inside measure, and 20 feet high. The frame was made of 2x12 studding, boarded on the outside with two thicknesses of inch lumber and building paper between. The inside was covered with sheeting lath and plastered with water lime as we would a cistern, leaving an air tight space of twelve inches between the two practically air tight partitions.

We cut and put into the silo when fit to cut and shock, a little over five acres of corn, weighing about 43 tons, filling the silo three-fourths full. It was then covered with two thicknesses of lumber with building paper between, the same as the outside, and weighted down with two cords of four foot wood. It was opened on the first of December and found to be a little mouldy under the cover and decayed a little at the outside, and in the corners, perhaps a foot deep. The remainder is a little tart but I think in good condition. It was run through a feed cutter when put into the silo.

I am convinced that the silo is a good thing, good for the small farm as well as the large one, and will soon be considered by most of us as indispensable. Any farmer who is about to build a barn or repair one, if he has not already a silo and does not thoroughly inform himself in regard to the silo, and make it a leading feature in his planning and building, will make a mistake.

Question: How many pounds of ensilage will an animal eat per day?

Mr. Cook: About 50 pounds, and gains 1¼ pounds per day.

Question: What is the best time to feed?

Mr. Cook: At night, because then there is more time than in the morning.

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Question: How much grain is cut up with the stalks in 50 pounds of ensilage.

Mr. Burnett: That doesn't make much difference. If 50 pounds of ensilage costs 3½ cents we can't complain.

Prof. A. J. Cook: An acre will keep an animal a year. I believe we can increase our capacity for keeping stock almost twice. My ensilage silo cost $126.88. That is too much. It can be made for almost half. All you want is an air-tight box, air space and building paper are not necessary. Make it air-tight and walls strong enough to hold. Don't cut the ensilage until the ears of corn are glazed. If corn is cut green it will smell bad. Best results are reached when corn is mature. Weighting is not necessary.

Question: Can clover be used as ensilage?

Prof. Cook: Clover has been used in New York and Wisconsin with good success. But you can raise more corn than clover per acre.

E. J. Cook: Best seed is dried clover hay fed with ensilage. What is best corn to use?

Prof. Cook: I think the Barrows & Wightman southern corn will prove best.

Question: How do you get the ensilage out of the silo? Do you keep it open?

Prof. Cook: Build a door from the bottom to the top, and take off from the top. Don't be afraid of its freezing. Don't expose it any more than is necessary. If it is fed every day it need not be covered.

DISCUSSION FOLLOWING PROF. JOHNSON'S PAPER ON ENSILAGE AT THE ITHACA INSTITUTE.

President Willits: Why are not roots in the rotation of crops at the college?

Prof. Johnson: The corn crop was substituted for roots largely, as ensilage is preferable to roots. Roots are expensive to grow, handle and store. Cattle need succulent food during winter, and ensilage is cheaper and more easily handled. We raise a few roots for breeding cows and calves. A silo is not an expensive structure, as its capacity is immense considering its size.

Question: How do you make a silo, and how do you fill?

Prof. J.: A silo is an air-tight compartment, either brick or wood. Sow your ensilage corn thin so that ears will form; cut after partially matured; run through a cutter box. Fill silo slowly (two feet per day) and pack down. Great weight is not necessary, and some do not weight at all; cover with boards and put on wood or stone. As to construction, build with studding and boards, then cover with tarred paper and boards laid crosswise of the first boards. Lath and plaster to preserve the wood, using water lime in the mortar.

Question: Do you always use corn for ensilage?

Prof. Johnson: We have one silo filled with clover. It is sweet and nice, but does not keep its color as well as corn.

Question: Is it necessary that a silo be air tight?

Prof. Johnson: Yes; it is the same principle by which fruit is canned.

Mr. ———: I read of a man whose silo was a hay mow and who didn't cut his stalks, and yet the ensilage came out all right.

Prof. Johnson: The same principle is illustrated where green clover is

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mowed. If it is covered up deep in mow and pressed down it will come out right; but if the same hay is put up on loft and placed where the air can get at it and dry it out, it will be musty and dusty.

Pres. Willits: What do you mean by purchasing commercial foods instead of commercial fertilizers?

Prof. Johnson: I think it much better to buy bran, oil meal, etc., and feed to stock, making manure in this way, than by buying commercial fertilizers direct.

Question: How much can we afford to pay for bran?

Prof. Johnson: Men from the East come out here and pay fifteen or sixteen dollars per ton for it. We can get it for thirteen to fourteen dollars.

DISCUSSION ON CLOVER SEEDING AT CASSOPOLIS, FEB'Y 13, 1883.

Mr. Poor: I have sown clover seed and dragged it in and think that best on clay land, on sand I would broadcast.

Mr. Drew: My best success is broadcasting with a wheelbarrow seeder.

Mr. Wiley: My best success in broadcasting is with a hand broadcaster machine.

Mr. McKee: Ours is a very heavy clay soil, and we find late March or early April best when a little snow covers the ground and before the frost is all out as, if we defer later, we can't get on the land till too late. We broadcast by hand and find no trouble in so doing.

Mr. Reed: One great cause of failure in seeding clover is raising too many crops of wheat on the land before seeding. I haven't failed in twenty-five years to get a good catch. I use the wheelbarrow broadcast seeder. Ground is heavy clay. I sow in wheat, last of March or first of April, and sow twenty acres in a day without trouble. Wait till the snow is off and land cracked open a little by the sun. I have tried harrowing alternate strips for two years, and couldn't see any difference in the result.

Mr. Dixon: We hardly ever failed in seeding, twenty-five years ago when our lands were stronger, but we have got to running our lands too hard and so we fail to get a catch of clover. I intend to sow this spring after a fallow and harrow seed in, and hope for a catch.

Mr. Barber: I've had bad luck lately. I sow one bushel to seven acres and wait till ground is dry enough to drag and sow by hand after drag and follow line of drill to guide me. I generally sow one field in the corn after the last time of cultivating, and in this way have been very successful. It does very profitably for pasture, and has given me as high as two tons per acre to turn under the next season.

Mr. Dixon: I think clover can be seeded on any soil with oats or wheat by sowing after danger of late spring frosts is past. I sow 100 lbs. of salt and plaster mixed in equal parts to the acre, and get good results It acts as a protection against injury from dry seasons. I could see no difference in yield of wheat on a field where part was so treated and part not, but straw was taller and stiffer where treated, and we got an enormous yield of clover. In St. Joseph county farmers who paid no attention to saving clover seed reported 40 bushels oats per acre where so treated, side by side with fields not so treated that gave but 17 to 20 bushels to the acre.

Mr. Kimerly: I believe drilling the most economical way of seeding, and think one quart per acre enough to seed it if all catches, but I always sow two quarts in fall and two quarts in spring so as to have a double chance.

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MINT GROWING.

[BY SAM. H. ANGEVINE.]

[Read at Cassopolis Institute, February 18, 1888.]

The first thing to be considered is what kind of soil should be selected for the crop. It would seem that its native element is low damp soils, as it is often found growing wild on the borders of streams; yet peppermint (mentha peperita) is well adapted to and will produce well on any kind of soil to be found in this latitude, provided there is sufficient substance to the soil to produce a cereal or root crop, but the richer the ground the better will be the results. During seasons of excessive drouth the low or marsh lands have a decided advantage, and in extremely wet seasons, the higher lands are better. Marsh land which is intended for planting should be placed during the previous June or July and thoroughly worked during the balance of the season in order to thoroughly subdue the native grass. It is also advisable to plow high land in the fall, especially if it be sod; the action of the frost of winter upon the freshly upturned soil destroys many of the seeds of noxious weeds and plants that would otherwise interfere with the growth of the mint plant. As soon as the frost is out of the ground in the spring and the soil sufficiently settled, mint planting begins. No time must be lost. Every available man is marched into the field. Some are fitting the ground while others are digging and conveying the roots to the field. The usual method of digging the roots is to turn them out with an ordinary plow. A potato digger is sometimes used. A heavy blade attached to the legs of a two horse cultivator is used by some. This implement runs under the row, severs the roots and leaves it in its natural position. Each of these operations, however, is followed by shaking the earth from the roots with forks. If the wagon for conveying the roots does not follow the diggers the roots must be thrown into convenient piles and immediately covered with dirt to protect them from the air and sun. The furrowing for the rows may be done with a common shovel plow, but a better and more speedy implement is a two horse cultivator with all the legs but two detached; these should be set the proper distance apart and provided with large shovels, a gauge should also be attached as for marking corn ground. The rows should be marked from 30 to 36 inches apart, 33 inches is the distance adopted by the majority of growers. The marks should be five or six inches wide and three or four deep.

The mint planter himself comprises a series of automatic arrangements which in an expert works with the utmost precision. Each planter is provided with a large sack, with two of its corners tied together, which is filled with roots and slung over the shoulders. The roots are intertwined and matted, and must be separated and thrown into the furrows with the hands and covered with the feet. An ordinary hand will plant in a day from three-fourths to one acre; but experts under the most favorable circumstances have planted two acres per day. Some growers drag the ground one or more times after planting and before the plants emerge from the ground. The drag should be light, and the teeth slant back as in the Thomas smoothing harrow. A slab drag may also be used successfully. After a sufficient number of the plants are up so that the rows can be followed, thorough culture must begin. Many growers cultivate with a single horse, but the newly im-

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proved two-horse cultivator does better work. Very small teeth should be used for cultivating while the plants are small, in order to enable the operator to work close to the row without danger of covering the plants. Larger teeth must be substituted and deeper tillage practiced as the plants increase in size. As soon as the cultivator starts, hoeing should also begin. Very small hoes are used, being lighter to handle and more convenient to work between the plants. Much care should be used in hoeing, so that the young plants that have not appeared above the surface will not be destroyed. The cultivating and hoeing must be frequent. It is of the utmost importance to keep the mint crop free from weeds, as they not only obstruct the growth of the mint plants, but when cut and distilled with the mint they impair the quality of the oil, and consequently the price must be lower than that of pure oil. When a majority of stalks have blossomed the crop has reached maturity and is ready for the sickle or scythe. Second crop mint may be cut with a reaper of the side delivery pattern, or a mowing machine may be used successfully by attaching to the rear of the cutter bar a temporary table made of light boards or sheet iron. In the use of this device an attendant must follow the mower with rake in hand, working back from the cutter bar the mint as it is cut, until a good sized forkful has accumulated, when it is raked from the rear of the machine. No machinery has yet been invented that will cut new or first crop mint successfully. A short, heavy scythe, attached to an ordinary snath is used for this purpose. The mint after being well wilted is raked with a horse rake and bunched as hay; the bunches, however, should not be large as there is much danger of heating, and this renders it worthless. Warm, dry weather is favorable for mint harvest. Cold and rainy weather is unfavorable, as it evaporates the oil. As I have in my description left the mint in piles, it is now ready to be taken to the distillery.

The cost of a distillery depends upon its capacity and the cost of the machinery used, and ranges from $150 to $1,000. There are about 250 distilleries in this State. Under the most favorable circumstances first crop mint has been known to yield as high as 40 lbs. per acre, but I think that 18 lbs. would be about an average in an ordinary season. The second and third crops are more uncertain, especially when grown upon high land. The second crop will not usually average more than 10 lbs. per acre. In the year 1840 mint was first grown as a crop in this State, a Mr. Sawyer, of Florence township, St. Joe county, having grown and distilled peppermint in that year. From that date the mint industry has gradually increased. Mr. Geo. E. Roys, of Florence, in a recent communication stated that "in the year 1847 peppermint oil sold at $1.25 per lb.; that the probable production of the entire world at that time was 10,000 lbs., and that the low price was attributed to over production." The world is now producing annually over 30 times that amount, and the gradual decline in the price of oil for the past two years has again, as in 1847, caused the growers to complain of over production. Three years ago the price of peppermint oil was, in St. Joseph county, $3.90 per lb.; to-day it is worth about $1.65 per lb. The range of prices for oil during the entire interval of its cultivation in Michigan has been from $1 to $5.50 per lb. for good oil. Stimulated by the high prices in 1885 the growers in the old mint localities largely increased their acreage. The industry has also reached out into other localities, even farmers in the territories are experimenting with the plant with a view of its production as a crop. A competition of gigantic proportions has recently sprung up in the

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shape of the so-called Japanese peppermint oil, "Mentha arvensis." This plant seems as nearly related to pennyroyal as to the true peppermint of our country, and, although a much inferior product, it is being used extensively in foreign countries, and as an adulterant to our oil. The production of peppermint in Japan is by no means of recent origin, yet during the last three or four years they have quadrupled their exports, which is evidence that they were stimulated to increased production, as were the Americans. The price of Japanese oil is usually about one-half of that of the best brands of the American product. Whether the dusky hued subjects of the Mikado can continue to furnish their oils at the present price is yet to be determined. It is reasonable, however, to believe that they will, as wages for farm hands in Japan is said to be about seven or eight cents per day. One of the principal uses of Japanese oil is for the manufacture of menthol, it being much richer in that element than American oil, which contains only 15 per cent of crystals, while that of Japan contains about 75 per cent. In 1886 Japan exported to foreign countries over 80,000 lbs. of peppermint oil. The amount exported from the United States during the same year was somewhat larger. The finest quality of peppermint oil in the world is produced at Metcham, England. The plant producing this oil differs from the ordinary plant of this locality. It is very tender and is easily injured by the action of the various elements and does not yield as much oil as the ordinary plant. The oil produced from this plant rules high and has been known to sell as high as $10 per lb.

St. Joseph county, Michigan, and its immediate surroundings produced in 1886 70,000 lbs. of peppermint oil, or about one-fifth of the product of the entire world. In the year 1887, although the acreage was largely increased, the yield was somewhat less on account of the excessive drouth which prevailed. The amount of peppermint produced in the entire world last year would be about 350,000 lbs., all of which is used for confectioners' and medicinal purposes.

DISCUSSION ON DEHORNING CATTLE AT CASSOPOLIS INSTITUTE.

Query: Should cattle be dehorned?

P. M. Henderson: I have had tussles with bulls that converted me to dehorning. A friend sent to Illinois for an expert to dehorn his animals. I had nine head, including a bull, dehorned and four of them did not bleed at all. The bull we cast and the others we dehorned in the stanchions. They used to be "cantankerous." Now they are like sheep, and being quieter, they take less feed. If one is dehorned all must be, or that one will be abused by the others. Confine the head and saw off with a fine saw.

Mr.— : Prof. Henry says, saw close to the hair or so as to take a little hair and they will not bleed. If you cut longer they will bleed.

Mr. — : I heartily endorse what Capt. Hendricks has said, and think it a humane act to dehorn cattle. If the horns are to be left polish them up and sharpen them and give them steel points so they may be effective.

Mr. Sparks: I think dehorning useless, cruel and wicked. Mr. Hendricks thinks it does not hurt them, but it is like the old lady who skinned eels alive for twenty years and said they had got used to it.

Mr. C. C. Morton: Dehorning is new. In Colorado last spring it was very popular. In August it was denounced as very dangerous, giving a chance for screw flies to work on the exposed stubs.

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Capt. Hendricks : As to cruelty. Mine were dehorned early last fall. The operation lasted but half a minute and they were turned out immediately and in ten minutes were eating in the yard. Often valuable animals are injured by being hooked.

Dr. Grange: I am lately from Wisconsin. When at one place I heard a paper against dehorning in which the writer and Prof. Hendricks said that animals under the operation bellowed and gave every sign of extreme pain. The friends of the operation claim great docility resulting. My experience is that cutting through bone is not seriously painful. I once had occasion to saw the bone of the leg of a dog and he wagged his tail during the operation. I saw Prof. Henry's dehorned animals, five steers, I liked their looks and found them as docile as sheep. They had been vicious previous to dehorning. I asked him as to exhibitions of pain in dehorning, and he said he did not think the operation especially painful. As to screw fly, the operation should not be done within six weeks of time that these flies deposit larvae.

SHEEP.

[BY E. H. STOW, POMPEI, MICH.]

[Read at Ithaca Institute.]

It is a mooted question whether sheep husbandry will or will not pay, at present prices of wool, on sandy, rocky or broken ground, unfit for the plow, or as scavengers on summer fallows or on bushy and foul pastures.

It shall be the aim in this article to show:

First: That good arable land may be profitably used for sheep husbandry, and

Second: That wool can be grown at a profit at present prices or at any price that it may be likely to fall to in the future.

It is not a fancy sketch but practical facts, as shown by the balance sheet of the past year.

Observe that it is not the result of fancy farming, neither fancy prices for fancy sheep that produces the results, but such results as any farmer ought to be able to equal or exceed.

The flock consisted of forty-five old sheep, one buck, and eleven lambs. There has been no account of the personal supervision. The manure has been counted as covering that:

DEBIT.

Forty-five sheep at $3.00 per head	$135 00
One buck	5 00
Eleven lambs at $2.00 per head	22 00
Interest on the above at 7%	11 34
Raising and harvesting three acres of millet	10 00
Rent of twenty acres of ground at $5.00	100 00
Haying	3 00
Shearing	4 58
Washing	1 00
Twine	35
Total	$292 27
Less rent	100 00
	$192 27

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CREDIT.

Fifty-one ewes (old) at $3.00	$153 00
Twenty-seven lambs (kept) at $2.00	54 00
One buck	5 00
Thirty-seven lambs (sold) $2.00	74 00
Three hundred and fifty-seven pounds of wool (washed)	125 05
Total	$411 05
Less debtor balance aside from rent	192 27
Divided by twenty, number of acres	$218 78
Equals rent received per acre	$10 93

Thus we have nearly eleven dollars per acre for the use of land and three and one-half acres of this is in orchard that is twenty-seven years old, and a part is wood pasture, and three acres of cornstalks, all estimated at full $5.00 per acre. And again the lambs were very low at $2.00, as I have since sold just such lambs for $3.00 per head. At this latter price there would have been a profit aside from the wool. Grain has not been overlooked, as the flock has not had any for a number of years.

The results on sheep husbandry nearly all turn on the care and feed. The above flock are long wool sheep, but the breed is not deemed the ch point. With good care, good feed, good shelter and good racks, success may be almost guaranteed.

Query: Which are the most profitable, short or long wool sheep?

Mr. Stowe: Long wool, by all means, coarse wool are more hardy. Mine are Cotswold. I haven't fed grain for years. Fleeces are between 6 and 7 lbs. I started with 7 sheep and now I have 80. Wool costs me little less than 3c. per lb., and it alone has almost paid entire expenses.

Query: Can you afford to feed good hay at present prices of wool?

Mr. Stowe: Yes, all they can eat.

Query: What is the best fodder?

Mr. Stowe: Everything. I recommend great variety. Cornstalks are good.

THOUGHTS ON LABOR.

[BY E. L. RUSSELL.]

[Read at the Tecumseh Institute, Feb'y, 1888.]

Labor is organized action, controlled by the human mind, a necessity to the enjoyment, happiness, prosperity and improvement of humanity. Mankind is born to labor and can be neither contented nor happy without employment, consequently men have in all ages of the world, sought occupation.

Agriculture was the first, is the prevailing, and will be the last pursuit, for while it is the grandest and noblest it is ever indispensable. However much labor may be diversified it all centers and depends upon agriculture, it takes the lead and is the barometer that indicates the rise or the fall of all other interests. Out of it have grown all other pursuits and professions of life, as

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the necessities, comfort and happiness of mankind have called for or demanded. Of the long list of occupations enumerated by the census of this State, all are dependent directly or indirectly upon agriculture.

A few years ago when the population of the United States was about 5,000,000 it required little or no machinery and but few agricultural implements to supply the demand for farm products. Few commercial agents and rude means of transportation were sufficient for all intercommerce. At the present time, when 50,000,000 of our own population, with large portions of the old world, are demanding supplies, improved machinery is necessary to produce it, and a complete system of communication and transportation is necessary to convey it, and nature's gigantic forces are required to assist labor, that all these millions may be supplied with the comforts and necessities of life. This gives diversity to labor; it calls for all classes: men of brain and men of muscle, men of wealth and men of talent, men of science and men of art, the common laborer and the skilled workman, the tradesman and the mechanic. Machinery was not invented and manufactured and the mechanical powers applied to the cultivation of the soil until they became a necessity, and the increase of population and the advancement of civilization demanded them. Neither do they rob the workman of his hire, but give diversity to labor. And while the farmer furnishes the supplies other classes furnish the means. One class cannot ignore the other; all belong to one great brotherhood.

atistics show that there are in this State nearly 631,000 individuals engag-
. in some kind of occupation. Out of this number they report over 237,000 as being engaged in agriculture. They neglect to give the ladies who do the housework on the farm, credit for any occupation. This would add 237,000 more to the force of labor, making over 868,000. Out of this number there are over 474,000, or more than one-half of the entire working population of the State, engaged directly in agriculture. This list embraces farm overseers, gardeners, nurserymen, dairymen, stock-raisers and others. It also embraces over 55,000 farm laborers. With the exception of farmers themselves this is the largest class enumerated as being engaged in any one pursuit. Next on the list is 31,000 domestic servants, which is the next largest class specified.

Many prosperous, happy farmers, now owning farms and homes of their own, date their commencement or start in life from the time they worked on a farm as a laborer.

The laborer cannot always find just such a home as he would prefer; neither can the employer always find just such a person as would be desirable to take into his family. This sometimes causes dissatisfaction and dissolution of partnership. To retain all its advantages and to discard all its disadvantages, it would be necessary to somewhat remodel human nature.

The farm laborer is entrusted with cares and responsibilities; his labors are varied and diversified; his day's work commences with the early morning, and ends late at night, when everything is looked after and cared for. The day has gone by when muscle and sinew is all that is required of a farm hand; he must be possessed of thought, intelligence, mechanical ingenuity and good judgment. Nowhere is labor to be ignored, but should be everywhere crowned with highest honor and praise. We must raise the standard of labor high if we do not desire to emulate Ireland's tenantry, Germany's peasantry, Russia's serfdom or India's pauperism. Gould or Vanderbilt may pile up mountains of gold by trading in railroad stocks, and Keene in

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buying and selling wheat options, but it adds no more to the welfare of the country than it would have done if it had been left locked up in the heart of the mountains, it contributes to the support of no one. But when they go to work and produce a bushel of wheat or construct an engine they add to the wealth of the nation, and contribute to the welfare and prosperity of the country. A good, vigorous, healthy, long-lived government protects person, operty and labor, and holds them as dear as its heart's blood.

Senator Sharon has said: "Without capital and capitalists our government would not be worth a fig," and, "the wealth of the country has to bear he burdens of the government and it should control it," and that "the capital of the country demands protection." His sentiments are fully and wholly our own. But who are the capitalists of our country? Where is the wealth and capital of our nation? There are probably in the United States over 20,000,000 inhabitants engaged in some kind of useful occupation. There is more wealth, more capital stock, more intrinsic value, more true worth in this army of workers than all the rest of the wealth of the nation. Were it not for these, our glorious, prosperous country and nation, with all its wealth and resources, improvements and developments, would have still remained a howling wilderness. Let this force stop operations but for one short year, aye, for six months—and all production ceases—and, as we never have a whole year's supply of produce in advance at any one time, the result is, there would be such a famine in the land as Herod never dreamed of—such a corner on corn as Joseph never conceived.

To-day the world holds those who are engaged in some worthy pursuit as honorable and fortunate, while it looks upon the idler with pity and contempt. The idler is never happy, contented nor successful; while fortune smiles upon, peace and prosperity go with, and happiness crowns the efforts of the industrious. Those who have youth, health and strength on their side, with hands to work, and head to control, are possessed of a mine of wealth that many a banker might envy. It is an inheritance of which no individual or law has a right to deprive you. It is an inheritance that should be more secure than title deeds. It is an unfailing commodity of exchange upon which there is no discount. It is a equivalent for all merchandise, gold and silver. You that possess it, treasure it well; never squander it, never let it lie idle, never barter it for dissipation or present doubtful pleasures; manage well the capital God has given you. It is a fearful matter for an individual to be thrown upon the cold world with no means of securing for himself food and shelter. I would advise every youth to begin life as though he expected to be obliged to fight life's great battles alone. Do not expect some friend to die, or to marry rich, or that some speculation or great event will turn up to give you a fortune; but be prepared to go alone and fight your own battles through life for yourself.

Young man or young woman, I care not what your situation in life is, hoose an honorable occupation, choose an occupation you love and take a pride in, be it simple or be it complicated; be it high or be it low, make yourselves master of it, learn it to perfection, be honest, count how many of your most talented acquaintances have bankrupted themselves by dishonesty, and you will ever find a desirable situation ready to receive you, and it will afford you happiness and pleasure to be able to pursue that you delight in. At the present time there is such a diversity of pursuits that you have a long list to select from. The census of this State gives a list of over 280-

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different occupations in which more or less individuals are engaged. Choose one that is worthy, and whatever you do, do it well; do your best and it will prove a blessing to yourself and mankind. Each one of you is wanted in the world's great workshop. Let your occupation be what it may, only so that it is honorable and honest, and you are everywhere hailed with joy and the right hand of brotherhood and good fellowship is extended to you by all with a hearty good will.

"In battle or business—whatever the game,
In law or in love—it is ever the same,
In the struggle for power, or the scramble for pelf,
Let this be your motto—Rely on yourself.
For, whether the prize be a ribbon or throne,
The victor is he who can—go it alone."

PRESERVATION OF FORESTS.

[BY E. A. BURNETT, OF BANCROFT.]

[Read at Owosso Institute Feby., 1888.]

The ruthless destruction of forests has already produced serious results in our own country; while in many European countries this question has become so important that schools of forestry have been established and stringent laws enacted in regard to the cutting of timber trees.

We do not appreciate the blessings we have always enjoyed. To our pioneers the forest seemed the greatest barrier to the advancement of civilizations, and they learned to rejoice in its destruction. In their struggle to subdue the forest many farmers gladly fell the last tree on their farms, little knowing the effect when others should clear the adjoining territory.

Let us study the influence of the destruction of forest growth in countries where time has been sufficient to mark its effect. The inhabited portions of the earth were once covered with forests. A vast wood belt stretched from the Pyrenees mountains, in Spain, to the Himalayas, of central Asia. From the Atlas mountains, in Africa, to the Mediterranean Sea was a forest belt.

History points to southwestern Asia as containing the most powerful nations of the earth. Her rich alluvial soil was covered with dense forests and supported a population of teeming millions. But the powerful nations of Asia have been reduced to nomadic tribes. The splendor of Grecian and Roman power has fallen. The once productive fields of northern Africa lie parched and barren, and Spain no longer leads the nations of the world. Some powerful natural cause must have exerted a mighty influence to produce this great change.

The countries bordering on the Mediterranean Sea, situated at the southern limit of the snow line, possess natural advantages for agriculture, not excelled by any modern nations. This densely wooded territory has been despoiled of its magnificent forest until in Rome but two per cent and in Greece but one per cent remain; while in Turkey almost the last bush has been destroyed for fuel.

Among the causes which have weakened these early nations one of the most powerful is a lack of food. The country once the garden of the world, now vibrates between fierce sand storms and drouths on the one hand and deluging rains on the other. The mountains have been denuded of their forests

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and from the seared and barren soil no moisture is evaporated to cool the air and promote gentle showers. When a storm breaks forth, there are no leaves nor roots to prevent the rapid escape of the water, and in its swift descent it carries away the nutritious elements of the soil, and leaves the country more seared and barren than before.

One of the first injurious influences noticed in the removal of forest growth, is the drying up of springs and rivulets caused by the destruction of leaves and humus in the soil which absorb the moisture and prevent the rapid escape of the water. Days are required for the removal of the water from the forest, where as many hours will suffice to drain the open field.

The forests modify extremes of temperature by promoting the evaporation of moisture from the leaves and soil. This moisture is condensed as it rises and falls in summer showers to again cool the air and promote the growth of crops.

Forests equalize the rainfall throughout the year and tend to prevent the fierce storms which sweep over the country, damaging crops and washing away the soluble elements of plant growth. The extremes of our western plains prove the value of trees in equalizing temperature and preventing destructive storms. Already we see the effect of these extremes in Michigan. Peaches are no longer a certain crop in the central part of our State, and many varieties of apples are disappearing with the increased severity of our winters.

The tracts of woodland break the severity of the winds, and holding the snow upon our wheat fields and meadows, prevent injurious freezing and thawing. As windbreaks for orchards, tree culture is of great and growing importance.

The destruction of forests is the cause of the gradual increased damage from floods. The water rapidly escaping from the open field during our heavy storms, swells the rivulets into turbid rivers which entering the main channel, overflows its banks, spreading destruction and ruin. The inundations along the Mississippi river and its branches have rapidly increased with the clearing up of the adjacent territory, and millions of dollars are now annually expended on the channel of the Mississippi alone, to prevent damage from floods.

Closely following the disaster of floods is the opposite evil—insufficient water supply. With the increased drouth of summer the streams dry up and river navigation is greatly injured. The sights of abandoned mills which dot our country and the many rivers which are no longer navigable, stand as witnesses of this fact and show the value of forests in maintaining a constant flow of water throughout the year.

The drifting sands of southern Spain, caused by the removal of her forests, have converted millions of acres of farming lands into desert waste. So terrible were its incursions that stone walls twenty feet high and hundreds of miles in length were built by the government to stay the drifting sand. But overcoming these artificial barriers, it buried whole cities in its course and continued to carry on its terrible work of destruction. In the last 300 years nine-tenths of the population of southern Spain have been driven from its once fertile fields by these drifting deserts. But not alone in Spain do we see its effects, for its influence has already reached *our State*, and the dunes of southwestern Michigan are producing much alarm along the lake shore.

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There are many facts tending to show that our deserts are the work of man. They were once fertile, wooded tracts, and and experiments in foreign countries show that forests are the only means of reclaiming them. The khedive of Egypt, by planting 6,000,000 of date and palm trees, has induced an annual rainfall of one inch where rain was before unknown.

Wonderful results have been produced on our western plains by irrigation and tree planting. Though irrigation may have been a potent element in introducing this change, tree growth has made it permanent. The valley of Salt Lake has been reclaimed. During the last 15 years the east line of the great American desert has been driven west 100 miles by forests and fields of waving grain.

There is no reason why the thousands of acres included in the pine barrens of our State which have produced such magnificent pine should not again be covered with forest growth. The value of lumber in the United States destroyed by forest fires amounts to many millions annually. Stringent laws should be enacted to protect our growing forests.

At the present rate of destruction our timber must soon disappear. We cannot long expect to draw in such immense quantities upon our northern pine without providing some means by which it may be replenished.

Great Britain, with ner cheap coal and cheap iron, annually expends over $100,000,000 for foreign lumber, and should our lumber fields become exhausted, the cost to this country which is yet to be developed would be enormous, provided a supply could be obtained at any price. Statistics say that the production of lumber in Canada has reached its limit, and we can expect no larger supply from there.

But how shall we prevent the destruction of the forests, with the increase of our farming population. Ah! happy the day when men learn to cultivate fewer acres with greater care. Not in broad acres of unproductive soil, laid barren through our neglect, but in its fertile valleys and rich productive hillsides does the wealth of this nation lie. Not to an indigent population unable to gain their daily bread by the products of their toil; but to an industrious, thriving people, in 8,000,000 farmers' homes do we look for our National prosperity. Experience has proven the best result obtains where one-third of the surface remains in woodland to protect the open field. Nature has produced the forest to shelter the cultivated crops. We must obey her law.

In the mania for destroying timber we have reached the limit. In southern Michigan there remains from one hundred and twenty to two hundred and forty acres of woodland per square mile, and while we economize what remains we must strive to maintain its present area. Increased severity of climate will destroy many of the older trees. As the lowlands and swamps become drained, the trees which are growing upon them, unable to adapt themselves to their changed conditions, will die. They should be the first to be removed, and the forest on the dry, arable land where fewer changes take place should be preserved.

Especially should we encourage and protect the young and growing trees in our timber belts. Having grown under more exposed conditions they will be better able to withstand the extremes of coming time. I have looked with horror upon the destruction of young and vigorous trees for hoop-poles, worth, when transported to market, but two cents, while scattered among these young and growing trees were other trees in a dying condition, any one of which would bring as great return as 500 of these growing trees.

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We must educate the people to know the value of our forest and provide stringent laws against setting forest fires. This, with schools of forestry and a judicious system of tree planting by individuals and by the government, will remedy the evil which might otherwise threaten the stability of the Nation. As each year the governor of our State sets apart an Arbor day, let us plant a tree, and as it grows, watch it, care for it, love it.

OUR FUTURE GOVERNORS.

[BY MISS MOLLIE CARRUTHERS.]

[Read at the Owosso Institute, Feb'y, 1888.]

We are not accustomed to regard the boys as responsible for the weal or woe of our National government, but it is from their ranks that America must some day choose her governors, therefore what manner of men they are likely to be is of some importance to the people whom they are to govern. It is not that we begin to look anxiously toward the rising generation to discover the few among them who may some day dazzle their countrymen with their brilliancy of intellect, but it is the character of young men of average ability upon which they are prompted to speculate, for they represent the element which really rules our country, through the medium of the silent little ballot. They are the background so indispensable to the historian's picture.

In a country's history the character of each generation is marked by the acts of a few people and by these their times are judged. The judgment passed, however, is not entirely the fault or the credit of those who figure prominently, for leaders are always what their followers make them by affording opportunity or making necessity for what they do. The office giver shares the responsibility with the office holder, hence the interest we have reason to feel in this class which bestows the power of government. It is something more than speculative, and the course taken by young men upon attaining their majority is interesting for the same reason, as an index to their career.

I would not attempt to instruct or advise any voter in his civil duties, but I do want to just remind the boys who have not yet commenced to vote, that when they are given the right to take a hand in governmental affairs, they also assume a responsibility. Their enfranchisement brings with it duties which they have no right to ignore and the sooner they begin to prepare themselves for the faithful performance of them, the better for their country.

Much of America's future lies in your hands, boys, and what you are, your country will be. You will have grave questions to decide, both moral and political. I know you have every intention of being loyal and true to your native land. Indeed, you are quite boiling over with patriotism at times. For instance, when the white sails of the defeated Thistle were retreating across the Atlantic, you fought the battles of '76 all over again. (I would not discourage that feeling, though, for England sends more formidable things than yachts.) You would resent as personal an insult to the stars and stripes, and if need be you would lay down your lives for the flag, willingly and gracefully, but you have something more to do. One genera-

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tion established America's independence, another vindicated her honor with their lives, but you have a task just as hard to perform, because it involves less of action and more of thought. Men of the last generation did their duty to their country by marching out and dying for it, but you can best do yours by remembering the principles which they established and by voting for what will best serve your country's interest, whether your candidate is elected or not; and he who does that is braver than he that taketh a Chicago convention.

Now, boys, you would not shirk these responsibilities. We know that there has been a deal of careless voting in the past, but you would not repeat the error and you would have little excuse for doing so, if you should, for no people before have had the facilities for getting information that you have. And no generation of Americans have had sterner questions to face than you will have. You will need wise heads and steady brains to arbitrate between capital and labor, to settle the vexed question of foreign immigration, and the temperance question—ah! that needs all your firmness. 'Tis a pity it must ever be brought into politics at all. If you would just decide the matter wisely for yourselves, individually, prohibition would not so badly need your vote and you would not need probibition. And farmers and farmers' sons, was there ever a time when you needed more to be interested in politics? Watch well the doings of this present congress and draw your own conclusions.

And, boys, there is another very solemn thing to consider. When you begin voting you are going to have all us women on your hands. You have to vote for us as well as yourselves. Think of the duty you owe your mothers. They may not have been talking to you about these things, indeed, they may know little of them; but, however that may be, they are of just as vital importance to them as to you. There is no occasion for their hearing much about them, but you are under obligations to know all there is to learn. Would you be careless with a trust so sacred? We know you love your mothers, though you are sometimes dreadfully afraid that someone will discover it. You seem to fear that it is an evidence of weakness to make any demonstration of your affection, but I assure you that there is no more beautiful picture than that of a young man showing unconscious devotion to his mother. It may seem unreasonable to you, but I think you ought to take your hat off just as gracefully to your own mother as to your best girl's mother.

I would not be understood to make the sweeping assertion that all young voters are careless and thoughtless of their obligations, but I believe a large proportion of them to be so. The fact is that our boys generally inherit their political affiliations and prefer to accept them and follow the example of their fathers than to think seriously about the matter themselves. Were it not a matter of business, of profession or of personal taste, one would feel no liberty to criticise, but this is a thing in which we are all concerned.

I think the apathy with which young men regard the subject is astonishing, for they are wide awake on every other. They are ambitious in business, intelligent in society and in sports. Oh! how enthusiastic about everything, from a grand military prize drill to a grand rowdy prize fight. And they display an aptness for learning the details of these sports, a quickness of comprehension that is wonderful to the uninitiated. Why, during the base-ball season one rarely meets a boy from 10 years old to 21 who cannot express

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a carefully formed opinion of the strength of every club in the league. He knew for weeks before the season ended, just the chance of each club to win the pennant. He would tell you promptly that Brouthers had the best batting average; he knew who had made the most home runs and he can tell you now just how many of the St. Louis Browns will play next year with the Brooklyn club. But ask some of those same enthusiasts who would be President of the United States if Grover Cleveland should die, and not more than three out of six would know, and the other three wouldn't care whether we should have any President or not. Our national game is all right for a pastime, but why will a young man spend so much time, study and investigation on a subject which has not a dollar's worth of importance to him (unless he bets) and when he comes to perform an action in which is involved honor, principle and duty to self and home and country make no preparation for it.

And just a last word, boys. We are on the eve of another campaign, and just now is a good time to begin looking the matter up. You may say that you do not want to mix up with politics, that they are corrupt and managed by a system of machinery. But you *will* mix up with them to the extent of voting and it is just such indifference as yours that makes machine politics possible, just such indifference that encourages toadyism to corrupt elements. Oh! boys of America, it is for you to decide what the next generation of our governors shall be. This is your duty to your country, and I charge you, do it truly and well. Think of the blood that has been shed to give you a land of freedom and liberal education, and make yourselves worthy of it by striving to be the ideal American citizens that Washington and Jefferson intended you to be.

Never until its citizens vote for principle instead of party, until they vote conscientiously and earnestly and insist that the men for whom they vote shall do their work in the same manner, will the United States be the model it ought to be. Then only will all fear of anarchism and rebellion be removed. I feel prompted to quote Longfellow's prophecy:

"Down the dark future, through long generations,
The echoing sounds grow fainter and then cease,
And, like a bell, with solemn, sweet vibrations,
I hear once more the voice of Christ say 'Peace.'"

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FARMERS' INSTITUTES.

Below is given a statement showing when and where winter institutes have been held by the Board of Agriculture since 1876, the date of the first institute:

Adrian	1876	Hillsdale	1877
Albion	1885, 1889	Howell	1879
Allegan	1876	Hudson	1881
Armada	1876, 1883	Hudsonville	1886
Bancroft	1887	Ithaca	1888
Bangor	1881	Ionia	1881
Battle Creek	1881	Jeddo	1883
Bay City	1879	Lake Odessa	1889
Berlin	1882	Lansing	1877
Berrien Centre	1884	Lapeer	1882
Big Rapids	1880, 1889	Leslie	1882
Brooklyn	1889	Macon	1882
Buchanan	1880	Manchester	1880, 1885
Caro	1884	Marshall	1878
Cassopolis	1882, 1888	Mason	1880
Centerville	1879, 1889	Monroe	1885
Charlotte	1879, 1887	Otsego	1884
Chelsea	1884	Owosso	1877, 1888
Coldwater	1876	Oxford	1881
Climax	1878	Paw Paw	1879, 1885
Decatur	1876	Plymouth	1885
Dowagiac	1879	Quincy	1886
East Saginaw	1886	Rochester	1876, 1886
Eaton Rapids	1884	Rockford	1880
Farmington	1883	Romeo	1880
Fremont	1887	Saginaw	1878
Flint	1879	St. Johns	1878
Flushing	1885	St. Louis	1886
Galesburg	1883	South Haven	1888
Grand Rapids	1884, 1888	Tecumseh	1878, 1888
Grass Lake	1886	Three Oaks	1887
Grayling	1887, 1889	Traverse City	1877
Greenville	1877, 1882	Trent	1883
Hanover	1887	Vassar	1881
Harrisville	1888	Ypsilanti	1877
Hastings	1883		

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A STUDY OF THE CYNIPIDAE.

C. P. GILLETTE, M. S.

Agricultural College, Mich., August, 1888.

Unless otherwise mentioned the specimens of galls and gall-flies from which the following notes and descriptions have been made were collected and reared by myself in the vicinity of Lansing, Michigan.

The Cynipidae, on account of their peculiar habits and wonderful instincts, form one of the most interesting families of insects for study and observation; and yet they have been so neglected by entomologists that the life histories of many of our most common species are very imperfectly known. The fact that I have taken not less than twelve or fifteen new species of cynipidous galls in the past eighteen months is proof enough that there is yet much to learn concerning this little gall-producing family of Hymenoptera.

One of the most unaccountable phenomena connected with the life histories of these insects is the fact that a leaf or twig of a plant will respond to the sting of a tiny insect and at once begin to build out of its own tissue a suitable abode for the little grub to live in, and, at the same time, furnish the tender inmate with abundant and proper food. In fact the vegetable excresences that we call galls seem often to depend on the health of the inmates for their own development. When I have found galls stunted in growth, or deformed, or turning dark in color as if about to die, I have almost invariably found the larval cynip parasitised and no longer able to assimilate food and grow.

It is hardly less wonderful that these almost microscopic insects should be able to go with such unerring precision to the same location on the identical variety of tree or plant that their ancestors chose in which to deposit their eggs. Some of the Cynipidae, it is true, attack two or even three varieties of trees or plants that are very closely related. I know of no case where a cynip, producing galls on one of the so-called white oaks, ever attacks one of the red or black oaks, or vice versa. For example, the gall-fly, *Holcaspis globulus* Fitch, produces bullet-shaped galls, which always occur on small twigs of Quercus alba. *Biorhiza macrocarpae* Bass., produces a gall which I have found very common on the under side of the leaves of *Quercus macrocarpa*, where they are always attached to the mid-rib or one of the veins, and it is never found on any other tree. On the other hand, *Cynips dimorphus*, Ash., ms. I have taken on the leaves of *Q. macrocarpa*, *Q. bicolor*, and *Q. prinus*, all white oaks.

Again we find no way to explain how it is that these little insects, so near alike that we are only able to separate them by the aid of a microscope, should possess the power to produce galls so different and yet so constant in size and form.

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The galls produced by any of the gall-producing cynips are as characteristic of that cynip as the fruit of any plant is characteristic of that plant. There is not a perfect gall in my collection that I could not determine with ease without ever seeing the fly that produced it.

A very interesting group of the Cynipidae is the sub-family Inquilinæ or guest gall-flies. This group comprises those cynips that no longer possess the power to produce galls for their own young, if they ever had such power. These flies seek the growing galls of other insects, not necessarily of the Cynipidae, in which to deposit their eggs. The eggs are laid outside of the central cell and the little larvæ grow to maturity without interfering with the well being of the grub of the true gall-fly. I have often reared a dozen or more of these guests from a single gall. Over one-quarter of the described Cynipidae in this country belong to this sub-family.

Parthenogenesis, alternation of generation, and many other interesting peculiarities of the family might be dwelt upon, but I will pass over these topics to speak of the great number of parasites that I have reared instead of the true gall-flies that I hoped to obtain. It would seem that the larval cynip, always protected by a wall of vegetable tissue, would be almost entirely free from the attack of parasitic insects, but quite the reverse is the case. It has not been uncommon for me to bring a large number of fine appearing galls into the laboratory fully expecting to get a good number of cynips, only to be disappointed by going to my breeding cages day after day to find parasites instead. A large number of the galls of *Amphibolips inanis* O. S., were taken from *Quercus rubra* in the summer of 1887, from which I estimated that over ninety per cent of the inmates were destroyed by parasites.

OBSERVATIONS ON DESCRIBED SPECIES.

Rhodites radicum O. S. My galls belonging to this species were received from a fruit grower near Lansing, Michigan, in May, 1887, and a fine lot of cynips were reared from them. The galls were taken from small roots of the raspberry and appeared as irregular knotty swellings from one-half to three-fourths of an inch in diameter. These galls, which grew beneath the surface of the ground, seem to have been better protected from the attacks of parasites and guest-flies, as only true cynips were reared.

I have never heard of the galls occurring in sufficient numbers to do serious damage. In the College garden several hundred raspberry bushes were transplanted and their roots examined for the galls but none were found.

Amphibolips coccinea O. S. So far as I can find, this species has always been reported as producing galls on *Quercus coccinea*. The only tree on which I have taken the galls is a small grub oak which, I was informed by a botanist, was probably *Q. nigrum*, but, as there was no fruit on the tree, the species could not be ascertained with certainty. On this tree there were not less than thirty or forty galls, the largest of which measured one and three fourths inches in their greatest diameter by one and one-half inches in their least diameter. These galls differ from the galls of *A. spongifica*, for which they are often mistaken, by occurring on *Q. coccinea* and *Q. nigrum* (?) instead of *Q. rubra*, by having a thinner outer shell, by having the surface more glossy and covered with small pimples, and by having the inner radiating substance matted about the central cell, from which it can easily be removed with the fingers, instead of having these fibers grown into a hard

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woody center surrounding the larval cell. The fly leaves the gall about the middle of June and its general color is a reddish brown. *A. spongifica* has two dates for appearing, a portion of the flies emerging in June and the remainder in October, and the general color of this species is black.

My specimens of *A. coccinae* began appearing June 16th. Neither guest nor parasites were reared.

Amphibolips spongifica O. S. (Cynips confluens Harris, and C. aciculata O. S.). Walsh speaks of this species in the American Entomologist as occurring plentifully on the black oak, *Q. nigrum*, but, although I have seen great numbers of these galls in both Michigan and Iowa on the leaves of *Q. rubra*, I have yet to find one on the leaves of *Q. nigrum*. The only flies that I have reared from these galls are those of the late part of the brood which began to appear October 3. On the 13th of October forty-seven galls were opened which gave seven true gall flies, twenty-seven parasitised galls, and the remainder blanks.

Amphibolips sculpta Bass. The beautiful translucent galls produced by this species I have taken on the leaves of *Q rubra* and *Q. coccinea*. They are attached to the under side of the leaves and may well be likened to large Delaware grapes in appearance. Galls taken in Michigan began giving flies June 21. Eight of these galls taken July 5 in the vicinity of Ames, Iowa, gave only parasites, two beautiful species of *Torymus*. No guests were reared.

Amphibolips inanis O. S. The gall of this fly is very common on the leaves of *Quercus rubra*. Large specimens are an inch in diameter. The galls are composed of a thin outer shell connected with the central larval cell by many thread-like radiating fibers. The flies begin to appear about the 20th of June. Over 90 per cent of the galls that I have collected have contained parasites. In the majority of cases, the central cell has been found to be crowded full of the parasitic larvæ of what I take to be a species of *Tetrastichus*. There is also a large species of *Torymus* that I have found common in these galls.

Andricus clavula Bass. The red swollen tips of the twigs of *Quercus alba*, which are the galls of the above named gall-fly, are very common in Michigan and Iowa. From these galls I have reared several specimens of the guest, *Ceroptes petiolicola*, but no true gall-flies.

Andricus corniyera O. S. When Baron Osten Sacken described the gall of this fly he had never seen the cynip that produced it. His specimens were taken on the pin oak, *Q. palustris*. The galls in my collection supposed to belong to this species were all taken on the red oak and may prove to be a new species. I have taken a considerable number of these galls and they all differ from a beautiful type which I have from the pin oak by being very much darker in color and more irregular and rough in outline. The galls appear like knotty swellings completely surrounding the small limbs. From all sides of the gall little seed-like bodies, much the shape and size of a small barley corn, are pushed out. These contain the larvæ of the gall-fly and fall to the ground some time in July, leaving the gall full of holes. I have a single imperfect fly taken from an immature gall.

Andricus futilis O. S. I have searched in vain for this gall in the vicinity of Lansing, but late in the fall of 1887 I found a small *Q. alba* in Ionia county, Michigan, standing in an open field, that had galls of this species on nearly every one of its dried leaves. The flies had made their escape so that no insects were reared.

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Andricus punctatus Bass. Galls rare, but are occasionally found on small limbs of *Q. rubra*. They vary from one half of an inch to two inches in diameter and are smooth knotty swellings surrounding the limbs much the same as the galls of *A. cornigera*. From these galls I have reared the guests, *Ceroptes petiolicola, Synergus lignicola* and an undetermined species; also the parasite *Decatoma varians*, but no true gall-flies.

Andricus seminator Harr. The brown, woolly galls, so common on the twigs of *Q. alba* in midsummer, are the product of this cynip. Galls gathered early in July gave flies the seventh of the same month. A green parasitic fly, a species of *Syntomaspis*, I have reared from these galls in fully as large numbers as the true gall-maker. No guests have been reared.

Andricus scitulus Bass. This species seems rare. I have taken a few of the galls on *Q. rubra* in the vicinity of Lansing, Mich., and near Ames, Iowa. In the latter case the galls were taken July 5, when the flies were found to be already escaping. A few specimens of two undetermined parasites were also reared. The galls are composed of a woody enlargement of the tips of the twigs.

Andricus flocci Wal. (*Cynips lana* Fitch.) Walsh marks this species "rare." I took a number of the galls from the leaves of *Q. alba* and *Q. macrocarpa* in Michigan and find it to be one of the most common galls on both these oaks at Ames, Iowa. The galls appear as little bunches of brown wool growing out from the mid-rib, or one of the main veins, on the under side of the leaves. Beneath the wool is a cluster of small seed-like bodies about as large as a very small kernel of wheat. Galls taken in Michigan te in the fall gave flies March 20. A few parasites, but no guests were ared. The flies appeared in abundance.

Andricus singularis Bass. Galls very common on *Q. rubra* leaves. In ape and structure these galls resemble the gall of *A. inanis*, but are much smaller, large specimens seldom attaining one-half inch in diameter. The galls project on both sides of the leaves, the larger portion always being below. Galls taken June 18 gave flies June 20. No guests were reared and the galls were little parisitised. Parasites undetermined.

Andricus petiolicola Bass. Galls found common on *Q. alba, Q. macrocarpa* and *Q. bicolor*. The galls are formed by the enlargement of a portion of the petiole of the leaf, and after the leaves have fallen, the galls stand out like little knotty projections. The galls that I have taken vary from 5-16 to 10-16 of an inch in diameter. Galls taken at Ames July 3 gave flies July 5. *Ceroptes petiolicola* is a very common guest in this gall.

Cynips dimorphus Ash. ms. Prof. W. H. Ashmead, of the Florida Exp. Station, informs me that he has this cynip and gall described in manuscript under the above name. Galls, red and globular, two to three m. m. in diameter, and arranged in clusters of from 10 to 30 or more on the under side of the leaves of *Q. prinus, Q. macrocarpa* and *Q. bicolor* in September and October. Rather common. Galls taken in the fall contained larval cynips on the first of July following.

Cynips strobilana O. S. The gall of this cynip I find quite rare. The galls are easiest found after the leaves have fallen. They have been taken from *Q. macrocarpa* and *Q. bicolor*. The individual galls are irregular, cone-shaped bodies, from fifteen to thirty of which constitute a cluster which always arises from a terminal bud. My largest cluster measures nearly two inches in diameter. Specimens taken last October still contain larvæ, (Sept. 20).

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The guest, *Synergus lignicola*, has been reared from the galls in considerable numbers and also a few parasites belonging to the genus *Eurytoma*.

Acraspis erinaceae Wal. (*C. pisum* Fitch.) Galls common in September and October on the leaves of *Q. alba*, usually on the under side. When growing they are of a beautiful rose or straw color and are covered with short spines or hairs. The gall is exceedingly hard when dry and the surface is made up of little seed-like projections, much resembling the surface of a strawberry. The galls seldom contain less than two or more than five larval cells.

The mature insect emerges in November and is wingless, or, rather, with only stubs of wings.

A very common parasite reared from this gall is *Decatoma flavius*.

Biorhiza forticornis Wal. (*Cynips ficus* Fitch.) Galls occurring near the tips of the twigs of *Q. alba*, almost invariably on young second growth shoots. A hundred or more are often crowded together about the shoots and appear much like a great number of little compressed sacks. When green they are light yellow in color, but are brown when dry. Common.

A few undetermined parasites only have been reared.

Holcaspis globulus Fitch. Galls globular, from three to six-eighths of an inch in diameter, composed of a corky material with an egg-shaped central cell, always occurring on the twigs of *Q. alba*. The fly emerges late in October or early in November.

Decatoma varians, an undetermined species of the same genus, and a species of *Eurytoma* have been reared as parasites on this fly. Common.

Holcaspis rugosa Bass. The gall and the fly of this species resemble very closely those of *H. globulus*. I have found the galls to be more highly colored than those of the latter species, and when matured they have a shriveled surface, while globulus is smooth. These galls have been taken on *Q. prinus* only, and are scarce. One guest, *Synergus ficus*, and the parasites, *Decatoma varians*, *Decatoma* sp., *Eurytoma punctiventris* and *Syntomaspis* sp., have been reared from the galls of this species.

Holcaspis duricoria Bass. (*H. mamma* Wal.) This is probably the gall-fly referred to by Walsh in a foot-note in the American Entomologist, Vol. I, page 102, for which he suggests the specific name *mamma*. Mr. Bassett described this insect and gave it the specific name *duricoria*, a name that has been accepted by European entomologists. For this reason, and for the farther reason that Walsh's description is not sufficient to distinguish the species with any certainty, I have given Bassett's name the preference.

The galls are very common on the twigs of *Quercus bicolor* and *Q. macrocarpa*. They may appear singly but are usually crowded together in clusters about the twigs. The galls, unless much crowded in the cluster, are subglobular in outline with a small teat-like projection. The fly, which much resembles *H. globulus*, *H. rugosa* and *H. Bassetti*, began to appear in the breeding cages Oct. 27. Fig. 3 is a full size representation of a cluster of these galls.

Two parasites, *Decatoma varians* and *Orymus ventricosus* were reared from this species.

Dryophanta papula Bass. These galls have been taken on *Q. rubra* and *Q. coccinea*. They consist of thickened portions of the leaves that are raised in many sharp points on the upper side. These thickened portions are lighter in color than the surrounding parts of the leaf and each little point seems to mark the location of the larval cell. Flies began to appear July 12. Rare.

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The great majority of insects reared from these galls have been parasites of the genus *Tetrastychus*.

Neuroterus noxiosus Bass. The galls are irregular swellings of the twigs of *Q. bicolor*. Galls taken in January gave the mature insects the last of March following. Galls not at all common.

The guests *Synergus lignicola* and an undetermined species of the same genus were reared. A number of the parasite, *Orymus minutus*, were also reared.

Neuroterus vesicula Bass. When the larva of this species is full grown the gall is a thin shell, globular in form, almost black in color, covered with light spots, does not exceed three mm. in diameter and is supported by the bud scales of *Q. bicolor* and *Q. macrocarpa*. Galls taken April 29 gave flies May 3.

Neither guests nor parasite were reared.

NEW SPECIES DESCRIBED.

GALLS ON WHITE OAK (*Quercus alba*).

Andricus foliaformis, n. sp.

Gall: Small wart-like projections thrown out from the mid-rib on the under side of the leaves from which there grows a leafy expanse that extends on all sides like the corolla of a rotate flower. (Fig. 1.)

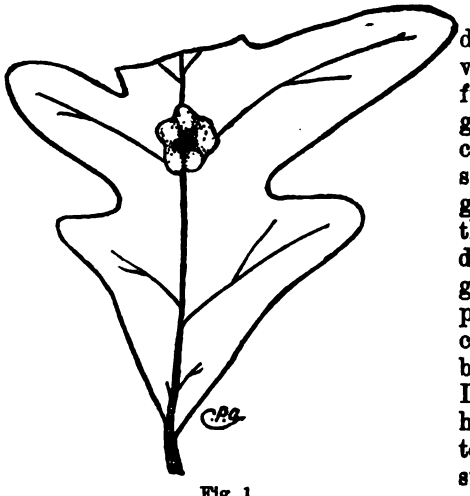

Fig. 1.

Gall-fly: Female. Head, dark reddish-brown with median line of face, vertex, and occiput almost black; front and genæ with many short gray hairs; vertex bare. Thorax from collar two-thirds of the way to the scutellum, between the parapsidal grooves, black; the remainder of the thorax brown. Parapsidal grooves distinct but not deep; outside of the grooves on either side a longitudinal patch of black is separated from the central black portion by a yellowish-brown line along either groove. Dorsal portion of thorax sparsely haired; pleuræ rather densely haired; tegulæ brown. Abdomen brown, smooth and shining, the darkest portion being on the posterior dorsal part. With a power of 50 diameters, minute punctures can be seen on the abdominal segments; second segment sparsely haired on sides. Scutellum with two foveæ at base separated from each other by a narrow ridge; rounded behind, black at base, changing to brown at the tip, and thinly set with long hairs. Head, thorax and abdomen, when examined with a power of 50 diameters, have a scaled appearance. Antennæ three-fourths the length of the body, 13 jointed, first and second joints stout, third joint longest, last joint nearly equal to the two preceding in length; slightly clavate and rather densely ciliated throughout; basal joints, yellowish-brown. Length of body, 1.5 mm.

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Described from a single specimen that issued July 30.

Biorhiza rubinus, n. sp.

Galls: When the leaves begin to turn in October, subglobular juicy galls about two or three mm. in diameter and rosy in color are found attached to the under side of the leaves. From a number of these galls collected in October, '87, four were selected and opened October 15, '88, from which one fully developed female cynip and three plump white larvæ were obtained.

Gall-fly: Shining black in color except the joints of the legs which are yellowish-brown. Head and thorax appear to be covered with shiny black scales. Clypeus with a number of rather stout hairs; a very few short hairs on front border of epicranium and on occiput; vertex bare. Antennæ 13 jointed, reaching the middle of the abdomen, first and second joints nearly equal in length and rather stout, the first somewhat stouter than the second, third joint longest and most slender, third to 12th gradually shortened, 13th once and a half as long as the 12th; brown-black in color and covered with a short gray pubescense. Parapsidal grooves are shallow and indistinct, but can be traced about one-third of the way from the scutellum to the collar. Scutellum much rounded behind and with two shallow foveæ at base. Abdomen a smooth glossy black. Legs rather thinly set with a gray pubescense; femurs with the same scaled appearance as the head and thorax; thorax sparsely set with short gray hairs. Length 1.5 m m.

SWAMP OAK (*Quercus bicolor*).

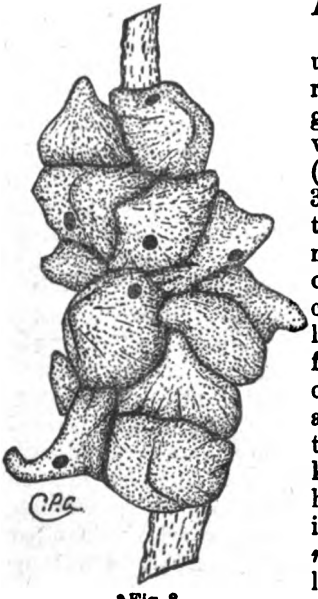

Fig. 2.

Holcaspis Bassetti, n. sp.

Gall: The gall occurs, sometimes singly, but usually in clusters about the twigs. The cluster represented at Fig. 2 was composed of 30 of these galls closely crowded together. The galls resemble very much the galls of *Holcaspis duricoria* Bass. (*Cynips mamma* Wal.) (Fig. 3). The galls are very much the shape that a thick waxy material would take if dropped on the twigs and then suddenly congealed, leaving stout, teat-like projections standing out from each drop. The central cell is placed low in the gall and can usually be seen protruding when the latter is broken off. Some entomologists have thought this gall to be identical with Walsh's *C. mamma*, but I have examined a large number of both forms and find the following points of difference, which convince me that this, if not a new species, is certainly a well marked variety:

Fig. 3.

H. Bassetti as compared with *H. duricoria*, is rather larger and is more irregular in outline. The teat-like

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projection is much heavier and longer in proportion to the size of the gall and appears to be a drawn-out portion of the substance of the gall, while in *duricoria* it is a small, hard pointed projection much resembling a spine in many cases, and often almost entirely wanting. In Bassetti the substance of the gall is more corky and easy to cut. The central cell, as before stated, is at the base of the gall, and when the latter is removed the point of the cell can usually be seen protruding below. Before the gall is detached the central cell is situated with its greatest diameter perpendicular to the limb at the point of attachment of the gall. In *duricoria* the cell is situated at the center of the gall; it never protrudes from below when the gall is detached; and it always has its greatest diameter parallel with the limb at the point of attachment of the gall. The central or larval cells are also differently shaped. In *duricoria* the cell is egg-shaped, while in *Bassetti* the end towards the twig is somewhat pointed, so that the cell is very much the shape of a plump apple seed with the point rounded off.

Gall-fly: Female. Median line of the face black, the black portion being broadest between the eyes; vertex dark brown to black; occiput black; orbits and genæ cinnamon brown; clypeus and lower border of epicranium black; mandibles black at base and tip, with the median portion brown; palpi a light amber color, with the terminal joints of the maxillary palpi infuscate; and all the joints set with gray hairs. The epicranium joining the clypeus is finely rugose. Antennæ 13 jointed; third joint the longest; joints from 3–12 gradually shorter; the 13th equal to the two preceding in length. The terminal joints, under a power of 50 diameters, appear distinctly fluted longitudinally. Color of the antennæ black, except the first two joints which are brown-black. All the joints are rather thickly set with a fine pubescense. Parapsidal grooves begin midway on the thorax and extend back to the scutellum. They are very shallow and to the unaided eye appear like two narrow black lines. A little forward of the grooves two parallel black lines arise and extend forward to the collar. Near the base of the wings on either side there begins another black line that runs to the scutellum. In the two latter cases the black lines are narrow, strips of the thorax that have no hairs growing upon them. Scutellum without foveæ or grooves, rounded and elevated posteriorly, covered with a yellowish brown pubescense, very irregularly rugose and black in color, except the tip, which is usually brown. Tegulæ brown. Abdomen shining black with silky pubescense on the sides of the second segment. Under a power of fifty diameters the sides of the abdominal segments appear crackled or scaled and finely punctate. Wings hyaline; cross veins black and heavy; radial nervure not reaching the costal margin. Length of wing 5.2 to 5.7 m m. Legs very dark cinnamon brown and rather thickly set with a gray pubescense. Terminal joints of tarsi black. Length 4.2 mm.

Described from nine specimens reared from the galls.

Cynips nigricens n. sp.

Galls in clusters attached to the mid-rib on the under side of the leaves. The galls are cone-shaped, and resemble very small galls of *C. strobilana*. The galls fall to the ground a little before the leaves drop in the fall. From a large number of these galls gathered in October, 1887, I obtained one perfectly developed female late in September, 1888. The fly may be described as follows:

Color, except joints of legs, tarsi, and venter, black.

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All parts of the insect expect the dorsal portion of the first two or three abdominal segments, and compound eyes, are rather densely and evenly covered with a short gray pubescense set in minute punctures.

Head: vertex and occiput appear to be covered with minute thick scales; clypeus and front rather coarsely punctate. Antennæ 13 jointed; first joint stout, third joint longest, third to seventh gradually shorter, eighth to twelfth sub-equal, thirteenth as long as the two preceding and with a slight indication of a division at its middle. The last five or six joints form a slight club and are fluted longitudinally. Length 2 mm. Thorax: parapsidal grooves distinct but narrow; widely separated at collar, and forming a double curve as they pass over the thorax to the scutellum. Two black parallel lines begin midway on the thorax between the parapsides and extend to the collar. Another slightly depressed line begins on either side of the thorax near the base of the wings and runs towards the scutellum. Thorax and scutellum with the same scaled appearance as the epicranium. Scutellum broad as long, obtusely rounded posteriorly and with two shallow fovæ at base. Wings: areolet small and indistinct; cubital nervure rather faint; cross veins rather heavy; radial nervure not reaching the costal margin. Length, 2 m m. Abdomen: the large second segment occupies about one-third of the abdomen; all of the segments punctured and set with many short gray hairs. Length of insect 3 m m.

BURR OAK (*Quercus macrocarpa*).

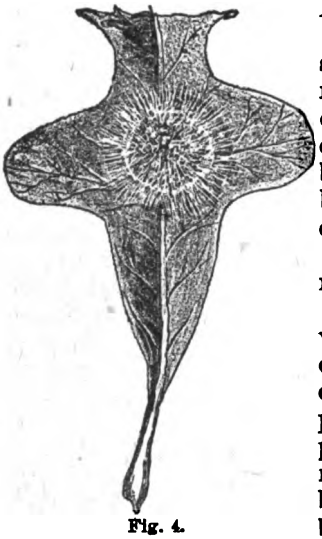

Fig. 4.

Acraspis villosus n. sp.

Gall: Hard globular excrescenses on the under side of the leaves and always attached to the mid-rib. (Fig. 4) Medium sized specimens measure 5-16 of an inch in diameter. The galls resemble rather closely the galls of *A. erinaceae* but differ from it by having a much heavier pubescense, by always being single-celled and by being light yellow in color.

Gall-fly: Sub-apterous females only have been reared.

Head: Median line of face, including clypeus, vertex and occiput, black. Orbits and genae dark cinnamon brown. In dark specimens nearly the entire face is black. Jaws and terminal joints of palpi black. Head and mouth parts sparsely pubescent. Epicranium, bordering clypeus, rugose; remainder of head punctate. Thorax, brown, bordered anteriorly and posteriorly with black. Parapsidal grooves wanting. Thorax and scutellum punctate and finely pubescent. Abdomen thickly set with a yellowish-gray pubescense that gives a decided velvety luster to the sides of the abdomen. The anterior dorsal portion of the second segment has a large bare spot that is continued in a narrow line back over the succeeding segments. The borders of the segments show as black rings crossing the velvety surface. Legs, brown; tarsi infuscate. Antennæ 13 jointed; third joint longest; last joint as long as the two preceding, and all of the joints rather densely haired. Length, 4 mm.

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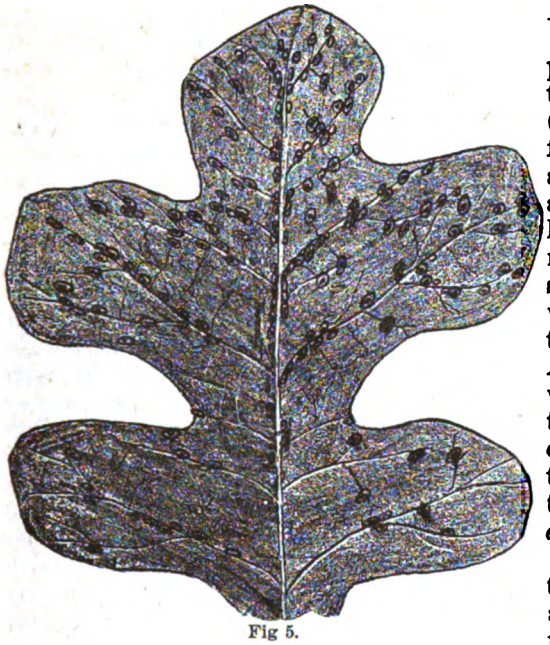

Fig 5.

Neuroterus nigrum n. sp.

Galls: The galls are little pimples about 2 mm. in diameter on the surface of the leaves (Fig. 5) and show equally well from above and below. There are usually a large number on a single leaf. The galls appear late in August but the flies do not emerge until the following summer. Few of these galls were noticed in Michigan, but they are very common about Ames, Iowa. My specimens were reared from the leaves of the burr oak, but in a number of instances I have taken galls that seem exactly similar on the leaves of the white oak, *Q. alba*.

Gall-fly: Color, except the tarsi, joints of the legs and antennæ, black. Head and thorax shining and with a scaled appearance when viewed with a high power. Thorax almost entirely free from hairs and without parapsidial grooves. The meso-thorax is notched posteriorly making it appear as if the scutellum was unifoveate. Scutellum broadly rounded behind; without fovæ or grooves; with a very few hairs; and with the same scaly appearance as the head and the thorax. Abdomen, shining black in color, with the ovipositor sheathes projecting. Antennæ with the first and second joints very stout and sub-equal in length; third joint longest, and the last four or five joints forming a slight club. The basal joints are sparsely and the terminal joints rather thickly set with short hairs; number of joints, 13. Eyes coarse; ocelli rather obscure. Wings, hyaline; areolet large; radial nervure reaching the costal margin; marginal cell open. Length 1.3 mm. Length of body, 1 mm.

RED OAK (*Quercus rubra*).

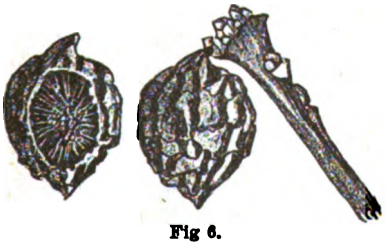

Fig 6.

Amphibolips Cookii n. sp.

Galls, (Fig. 6) globular, with a central larval cell held in place by stout radiating fibers. When green, the galls resemble very much the growing galls of *Amphibolips inanis* O. S. The gall differs from that of *A. inanis* by having a thicker outer shell, by having much stouter radiating fibres, by being somewhat drawn out into a point at either extremity, and by occurring on the buds instead of the leaves. The galls fall with the leaves or before them, and, when dried, the outer surface is much shriveled in appearance. About a pint of these galls were gathered,

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some late in the fall and others early in the spring, under a large red oak. On cutting into these galls the first day of September following, five fully developed flies and one pupa were found, all females.

Gall-fly: Head small; clypeus and jaws punctate; vertex, occiput, and median line of front coarsely pitted or sculptured; genæ and sides of the face deeply rugose, the furrows spreading out like a fan from either side of the clypeus; entire head jet black and rather thinly set with a grayish pubescense, except on the vertex, where it is bare. Jaws black; palpi brown. Antennæ reach the middle of the abdomen; 13 jointed; third joint longest; joints 3-12 gradually shorter; 13th joint next to the third in length and as long as the 11th and 12th together. Thorax entirely black. Parapsidal grooves present but very indistinct and can be traced about one-third of the way from the scutellum to the collar. Between and a little in front of these grooves arise two parallel black ridges that appear as minute shiny lines which extend forward to the collar. Two other similar lines start midway on the thorax a little outside of the parapsidal grooves near the base of the wings and extend back to the scutellum. Thorax and scutellum deeply sculptured and sparsely set with short gray hairs. Scutellum with two large fovæ at the base separated by a narrow septum; subquadrangular in outline and rounded and elevated posteriorly. Abdomen varies from a very dark amber to almost black; segments densely and finely punctate when examined with a power of 20 diameters; lateral portions of second segment very sparsely pubescent. Legs dark amber in color except the tips of the tarsi which are black; finely pubescent throughout; coxæ black. Wings seven to eight m m. in length; somewhat smoky, and with a large stigmal spot at the base of the marginal cell. Length of body five and one-half mm.

The following is a list of the cynipidous galls taken in the vicinity of the Michigan Agricultural College. I have in each case given the variety of oak upon which they were taken, the date that the flies emerged, when reared, and the guests and parasites reared from the different species:

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Name of Gall-fly.	Taken From.	Gall Taken.	Fly Emerged.	Guests.	Parasites.
Rhodites radicum O. S.	Raspberry roots	May	May 24		
Amphibolips coccinea O. S.	Q. coccinea leaves	June 14	June 16		
Amphibolips Cookii n. sp.	Q. rubra buds	November 10, '87	September 1, '88		An undetermined species.
Amphibolips inanis O. S.	Q. rubra leaves	June 16	June 21		Torymus sp. Tetrastichus sp.
Amphibolips nubilipennis H.	Q rubra leaves	June 20	June 25		An undetermined species.
Amphibolips sculpta Bass.	Q. rubra leaves	June 18	June 20		Syntomaspis sp.
Amphibolips spongifica O. S.	Q. rubra leaves	July	October 8		An undetermined species.
Callirhytis clavula Bass.	Q. alba twigs	March		Ceroptes petiolicola O. S.	
Callirhytis cornigera O. S.	Q. rubra twigs	November			
Callirhytis futilis O. S.	Q. alba leaves	December			
Callirhytis punctatus Bass.	Q. rubra limbs	April		Synergus lignicola O. S. Ceroptes petiolicola O. S.	Decatoma varians Wal.
Callirhytis scitulus Bass.	Q. rubra twigs	November			An undetermined species.
Callirhytis seminator Harr.	Q. alba limbs	July 5	July 7		Syntomaspis sp.
Andricus foliaformis n. sp.	Q. alba leaves	July 29	July 30		
Andricus flocci Bass.	Q. alba and Q. macrocarpa leaves	December	March 5		Tetrastychus sp. Eurytoma sp.
Andricus futilis O. S.	Q. alba leaves	December			
Andricus petiolicola Bass.	Q. bicolor and Q. macro- leaves	July 3	July 5	Ceroptes petiolicola O. S.	An undetermined species.
Andricus singularis Bass.	Q. rubra leaves	June 5	June 8		An undetermined species.
Cynips dimorphus Ash.	Q. prinus leaves Q. bicolor " Q. macrocrapa leaves	September 24			An undetermined species.
Cynips nigricens n. sp.	Q. bicolor leaves	October 10, '87	September 25, '88		An undetermined species.
Cynips strobilana O. S.	Q. bicolor and Q. macrocarpa twigs	March		Synergus lignicola O. S.	Eurytoma sp.
Acraspis crinaceae Wal.	Q. alba leaves	October 20	November 5		Decatoma flavus.
Acraspis villosus n. sp.	Q. macrocarpa leaves	October 20	October 29		Eurytoma sp.
Biorhiza forticornis Wal.	Q. alba twigs	September			An undetermined species.
Biorhiza rubinus n. sp.	Q. alba leaves	October 12, '87	October 15, '88		

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Biorhiza macrocarpae Bass.	Q. macrocarpa leaves	October 1	October 10		
Holcaspis globulus Fitch	Q. alba twigs	October 15	October 29		Decatoma varians Wal. Decatoma sp. Eurytoma sp.
Holcaspis duricoria Bass.	Q. macrocarpa and Q. bicolor twigs	October 18	October 23		Orymus ventricosus. Decatoma varians Wal.
Holcaspis Bassetti n. sp.	Q. bicolor twigs	October 18	October 31		Orymus ventricosus. Orymus sp. Decatoma varians Wal.
Holcaspis rugosa Bass.	Q. prinus twigs	October 15	October 20		Eurytoma punctiventris Wal
Dryophanta papula Bass.	Q. rubra leaves and Q. coccinea leaves	July 8	July 12		An undetermined species.
Neuroterus nigrum n. sp.	Q. macrocarpa leaves	October 20	May 10		An undetermined species.
Neuroterus noxiosus Bass	Q. bicolor twigs	January 3	March 24	Ceroptes petiolicola O. S. Synergus sp.	Ceroptes sp. Orymus minutus.
Neuroterus vesicula Bass.	Q. bicolor and Q. macrocarpa buds	April 29	May 3		

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MICHIGAN STATE AGRICULTURAL SOCIETY.

PROCEEDINGS AND AWARDS FOR THE YEAR 1888.

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PROCEEDINGS OF THE EXECUTIVE COMMITTEE WINTER MEETING.

FIRST DAY.

RUSSELL HOUSE, DETROIT,
January 9, 1888.

The regular annual meeting of the Executive Committee of the Michigan State Agricultural Society was held at the Russell House, Detroit, this evening, President Chamberlain in the Chair.

The roll was called, and the following named gentlemen answered to their names:

President Chamberlain, Treasurer Dean, Messrs. Hanford, Ball, Lessiter, Cobb, Sharp, Reed, Smith, Burrington, Wood, Shoemaker, J. P., Young, Butterfield, Anderson, Wells, Phillips, Fralick, and the Secretary.

PRESIDENT CHAMBERLAIN'S ADDRESS.

Gentlemen of the Executive Committee of the State Agricultural Society:

In retiring from the position of President of the Society, which I have had the honor to hold for two years, it is proper I should state to you what has been done during the year past, and make such recommendations as might seem wise to adopt. The total expenditures of the Society for the year, as will appear in the financial report, amount to $21,526.27. The receipts amount to $18,874.15, leaving a deficiency of $2,647.12. Of the expense, $9,633 was paid for premiums, $1,400 was paid the State Horticultural

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Society for their exhibit; $800 to Madame Marentette for exhibition of trained horses. This special attraction was proposed by Mr. Sterling, the Secretary, and on consultation with the Business Committee, we concluded to accept the proposition made to exhibit the fleetness of their horses on the track on each day of the Fair, and also of the celebrated saddle horse. I am not sure but the expense was more than the profit to the Society.

One thousand dollars paid the Secretary and $500 for a book-keeper for the Treasurer are all the salaries paid to officers of the Society or members of the Executive Committee. The balance of the expense account was incurred in holding the regular and special meetings of the Society, for forage, printing and expenses of preparing and holding the Fair. The amount expended in premiums is about the same as in former years, while the general expense is several thousand dollars less than usual. The citizens of Jackson donated to this Society the sum of $1,500, which was largely used in rebuilding sheds and pens destroyed by fire in the spring (this property was lost by a fire originating in the State Prison yards), and in making needed repairs necessary for holding the State Fair. You decided at the winter meeting to hold the Fair upon the third week in September, as had been your custom to do for several years. Through some misunderstanding as to the prerogative of the State Society, or by intent, the fairs of the West Michigan Agricultural Society and the Northeastern Society were fixed to be held on the same week as the State Fair, together with the meeting of the Detroit Driving Club Association in Detroit. You were probably as much surprised as myself to learn that all these fairs were to be held at the same time. I wrote the Hon. H. C. Sherwood, President of the West Michigan Society, saying I thought it unwise to hold the three fairs upon the same week, and asked if a change could not be made in the time of holding the Grand Rapids Fair. Mr. Sherwood replied, saying he regretted it as much as myself, and suggested that the State Fair might be held one week earlier. I conferred with the Secretary and Chairman of the Business Committee, and we concluded we could not make any change at that late day. I would recommend that some full understanding be had between the State and District Societies as to time of holding fairs, as it would doubtless be better for exhibitors and all concerned.

Notwithstanding the Fairs at Grand Rapids and Flint and the meeting of the Trotting Association at Detroit, the entries at the State Fair in most departments were large, and in the stock, carriage and implement departments never better. The exhibition was fine. The attendance of visitors Monday, Tuesday and Wednesday was a full average. Thursday again this year was a wet day, and the gate receipts were light. Friday was a good day, the receipts were good, owing largely to the competitive military drill between the Jackson Guards and the Agricultural College Cadets, which was arranged through the instrumentality of Capt. H. F. Hatch of the Jackson Guards, without expense to the Society. The grand stand was well filled during this drill. I desire to thank the members of these companies for their interest in the success of the State Fair, and am satisfied it will be well for this Society to encourage the military companies of the State by offering a suitable premium this year for a competitive drill upon the Fair grounds.

The special meeting of this committee was held at Lansing in June, but

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owing to the heavy rain that occurred upon that day we were unable to visit the College, much to our disappointment.

Owing to our limited finances, I would recommend the postponement of visiting the College this year by the Executive Committee, but would recommend that a committee of three be appointed to visit the College during the year, and report at the winter meeting. By an act passed at the last session of the Legislature, the Executive Committee of the State Agricultural Society are authorized to locate the State Fair permanently, when a majority of this committee are agreed upon one place. Under certain conditions I should favor a permanent location. These conditions I have expressed in a former communication.

Whatever may be said in favor of local or district agricultural fairs, nothing, in my opinion, can take the place of or have the influence or effect at home or abroad equal to that of a first-class State Fair. Many of the States of the Union, like Ohio, Illinois, Iowa and Kansas, appreciating the benefit of their great State Fairs in stimulating and encouraging agriculture, have made ample provision for their support. Michigan has the resources and stands well among the leading agricultural societies of the country for furnishing good exhibitions and dealing liberally with its patrons. I am of the opinion the time has passed when we should exclude foreign stock from our exhibitions. I recommend that our rules be amended, and that competition hereafter be thrown open to the world in all departments of the Fair.

The rules governing the management of the Fair were adhered to so far as I am informed, and it is exceedingly gratifying to me to know that our Society can hold a Fair without admitting to the grounds shows of questionable character or permitting the sale of beer and intoxicating liquors. While considerable money might be obtained from this source, it was apparent to all who attended the Fair last year, that the absence of this objectionable feature named was appreciated by the people. Another thing was remarkable, that during the Fair not a single arrest was made upon the Fair grounds for disorderly conduct. It may be urged by some that there would have been no deficiency in receipts had we allowed beer to be sold on the grounds. I do not attribute this deficiency in the receipts to the fact that we ran a "dry" Fair, but more to the fact we had too much "wet" on Thursday.

It was my privilege to attend the Provincial and Dominion Fair, held in Toronto last fall, in company with several gentlemen from this State. We were cordially received and highly entertained by the officers of the Toronto Fair. I was surprised at the magnitude of their exhibition, exceeding anything I had seen in the States; our Canadian friends evidently understand how to run a successful fair. They have good grounds, substantial and commodious buildings; the grounds are lighted at night by electric lights, and visitors are admitted in the evening, where, in addition to the regular exhibition, entertaining amusements are furnished. No liquors or beer are allowed to be sold on the grounds. The people attend the fair from all over the Dominion, and the managers have made it a success. Competition was open here to the world.

In my opinion the time has come when some changes should be made in the manner of conducting the affairs of the Society, and I recommend that the members of the business committee be paid for their services in preparing for the fair $3 per day and necessary expenses; that the purchase of forage and all supplies necessary for the Fair be made by them; that the assigning

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of stalls, sheds, pens and space for exhibitors be under their charge; that they make all the arrangements necessary for the opening of the Fair, and turn over to division superintendents, on the first day, everything in readiness.

I also recommend that the president be paid a salary sufficient to enable him to give proper attention to the interests of the Society. I believe that he can accomplish enough to more than compensate for any reasonable expense for his services. I think this can all be done and yet save money from the expense account. It is not reasonable to ask these gentlemen to give their time, as has been done in the past, without compensation.

In the election of Mr. Hyde as my successor this Society is fortunate in having secured the services of a gentleman well known in the State, and whose long experience in connection with this Society will enable him to direct its affairs wisely and well.

Thanking you, gentlemen, for the efficient aid you have given me, I hope prosperity and success may attend your efforts to advance the usefulness of the State Agricultural Society of Michigan.

SECRETARY'S REPORT.

To the President and Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN,—I would respectfully submit the following report as a statement of the transactions of the Secretary's office for the year 1887:

Two hundred and thirty-three business orders amounting to $11,888.27 were drawn upon the Treasurer for the payment of accounts, audited by the Business Committee and countersigned by the chairman of that committee. A record of the above orders will be found in the register of accounts for the year and upon the stubs of the orders. Vouchers corresponding with the orders are on file in the Secretary's office.

The details of the general expenditures of the Society have been classified and arranged under the proper head; the items will be found in the report of the Business Committee.

Three hundred and sixty-one checks amounting to $9,633.00 were issued by the Secretary and countersigned by the President for premiums awarded at the 39th Annual Fair. A full and detailed statement giving number of check amount, and name of the party to whom issued, will be found in the schedule accompanying the report.

Three premiums awarded to horses in classes 10 and 15 were protested; these premiums amounted to $27.00, and upon final adjustment this sum will have to be added to the amount of premium checks already issued, making a total of premiums for the year $9,660.00.

The following table will show the amount of cash and number of medals and diplomas offered and awarded in each division:

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CASH PREMIUMS.

Division.	Offered.	Awarded.
A—Cattle	$2,965 00	$2,907 00
B—Horses	3,368 00	2,458 00
C—Sheep	1,584 00	1,505 00
D—Swine	885 00	732 00
E—Poultry	360 00	146 50
F—Farm products	541 50	348 50
G—Dairy and other products	189 00	121 00
H—Bees and honey	266 00	266 00
I—Farm implements		
J—Vehicles		
K—Machinery		
L—Manufactured goods	438 00	231 00
M—Musical instruments and sewing machines	23 00	2 00
N—Art	877 00	678 00
O—Needle and fancy work	325 50	234 00
P—Miscellaneous	113 00	6 00
Q—Children's department	50 50	25 00
Total	$11,905 50	$9,660 00

MEDALS AND DIPLOMAS.

Division.	Diplomas.		Medals.	
	Offered.	Awarded.	Offered.	Awarded.
D—Swine	6	6		
L—Manufactured goods	1	2	1	1
M—Musical instruments, etc.	7			
O—Needle and fancy work	2			
P—Miscellaneous	1	1	2	
Total	17	9	3	1

The following is a list of entries in each class and division:

DIVISION A—CATTLE.

Class.		
1—Shorthorns	108	
2—Devons	47	
3—Herefords	69	
4—Jerseys	68	
5—Galloways and Polled Angus	47	
6—Holstein-Friesians	88	
7—Grades	47	
8—Fat cattle	35	
Total		509

DIVISION B—HORSES.

9—Cleveland Bay and other coach horses	7	
10—Thoroughbreds	15	
11—All work	110	
12—Roadsters	35	
13—Breeders' stock	33	
14—Gents' driving horse	24	
15—Clydesdale and English draft horses	44	
16—Norman Percheron and French draft horses	14	
17—Draft horses (not registered)	28	
18—Carriage and buggy horses	63	
19—Roadster stallions (standard)	23	
20—Roadster mares and geldings (standard)	28	
21—Stallions, mares and geldings under saddle	8	
22—Sweepstakes for stallion with five of get	19	
Total		446

DIVISION C—SHEEP.

23—Thoroughbred American Merinos	92	
24— " " bred in Michigan	91	

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25—Fine wool grades	22	
26—Southdowns	30	
27—Shropshires	127	
28—Hampshires	27	
29—Oxfords	48	
30—Cotswolds	44	
31—Leicesters	33	
32—Fat sheep	20	
Total		732

DIVISION D—SWINE.

33—Berkshire	43	
Essex	55	
Suffolk, small Yorkshire and Victorias	47	
Poland-Chinas	80	
Duroc-Jerseys	23	
Chester White and other large breeds	23	
Fat hogs	13	
Total		284

DIVISION E—POULTRY.

34—Poultry		320

DIVISION F—FARM PRODUCTS.

35—Grain and seeds	119	
36—Roots and vegetables	237	
37—Display of roots and vegetables	3	
38—Flour, meal and feed	3	
Total		362

DIVISION G—DAIRY PRODUCTS, ETC.

39—Butter, cheese and dairy products	63	
40—Sugar, bread and pickles	56	
41—Soap, toilet articles, etc	7	
Total		126

DIVISION H—BEES AND HONEY.

Class.	Entries.
42—Bees, Honey, etc	164

DIVISION I—FARM IMPLEMENTS.

43—Plows	108	
44—Tillage implements	169	
45—Seed drills, sowers, planters, etc	151	
46—Haying and harvesting implements	200	
47—Machinery preparing crops for market	62	
48—Miscellaneous farm machinery	185	
Total		875

DIVISION J—VEHICLES.

49—Wagons, carriages, etc		299

DIVISION K—MACHINERY.

50—Machinery for working wood, iron, etc	114	
51—New articles of machinery		
Total		114

DIVISION L—MANUFACTURED GOODS.

52—Materials	2	
53—Factory made	2	
54—Articles of dyes	9	
55—Articles of leather and india rubber	39	
56—Articles of furniture	67	
57—Stone, iron, and concrete work	18	
Total		137

DIVISION M—MUSICAL INSTRUMENTS, SEWING MACHINES, ETC.

58—Musical instruments, sewing machines	17	
59—Surgical and other instruments	2	
60—Clocks, jewelry, etc	2	
Total		21

DIVISION N—ART.

61—Painting, sculpture, etc. (professional)	159	
62—Painting and drawing (amateurs)	88	
Total		247

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DIVISION O—NEEDLE AND FANCY WORK.

63—Articles of ladies' dress	21	
64—Plain needle and machine work	72	
65—Embroidery and fancy needlework	145	
66—Crochet, knit and fancy work	92	
67—Hair, shell and wax work	26	
Total		356

DIVISION P—MISCELLANEOUS.

68—Miscellaneous articles	11	
69—Household articles	11	
70—Printing and stationery	2	
Total		24

DIVISION Q—CHILDREN'S DEPARTMENT.

Children's work	41
Total entries in all departments	5,117

The following moneys coming into my hands as Secretary of the Society have been paid to the Treasurer and his receipt taken for the same.

From annual membership	$614 00
" Rent of stalls	344 00
" Forage fees	349 90
Total	$1,307 90

During the year Articles of Association have been filed in this office by the "Bancroft Union Market Fair Association" and the "Flint River Valley Agricultural Society."

INVENTORY OF PROPERTY IN THE SECRETARY'S OFFICE.

American Shorthorn Herd Books	32 vols.
American Jersey Cattle Club Herd Register	23 "
Dutch Friesian Herd Book	3 "
Holstein Herd Book	9 "
Holstein-Friesian Herd Book	2 "
North American Galloway Herd Book	2 "
Pedigree of English Shorthorn Bulls	1 "
American Stud Book (Bruce)	3 "
American Berkshire Record	4 "
Vermont Merino Sheep Register	1 "
Michigan Farmer for years '45 to '54	8 "

Agricultural Reports of Michigan, Ohio, Indiana, Illinois, New Jersey, Massachusetts, Connecticut, Maine, Iowa, Kansas, Missouri, New Hampshire, California, Upper Canada, Department of Agriculture, and Michigan Horticultural Society Reports.

1 Office desk,
1 Society seal,
1 Gold medal,
6 Ink stands,
2 Bill files,
2 Letter files,
1 Postal scale,
1 Pair shears,
12 Spindles.
5 Boxes for books.

J. C. STERLING,
Secretary.

Accepted and referred to Finance Committee.

TREASURER'S REPORT.

FAIR HELD AT JACKSON, 1887.

January, 1887, balance cash on hand $6,486 18

RECEIPTS DURING THE CURRENT YEAR.		DISBURSEMENTS.	
Membership certificates	$695 00	Paid business orders	$11,888 27
Gate admissions	13,806 05	Paid premium checks	9,611 00
Booth and ground rents	2,124 50	Paid premium checks (previous issue)	22 00
Check room	54 70	January, 1888, Balance cash on hand	3,839 06
Stall rent and forage	693 90		
A. O. Hyde (Jackson subscription)	1,500 00		
	$25,360 33		$25,360 33

A. J. DEAN,
Treasurer.

Accepted and referred to Finance Committee.

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STATEMENT OF BUSINESS COMMITTEE IN DETAIL.

WINTER MEETING EXPENSES.

1887.	No. Order.		
Jan. 14.	3	William Chamberlain, expenses	$9 35
	4	James M. Turner, expenses	10 20
	5	M. P. Anderson, expenses	7 55
	6	A. F. Wood, expenses	3 90
	7	John Lessiter, expenses	1 50
	8	W. J. Baxter, expenses	5 75
	9	I. H. Butterfield, expenses	5 60
	10	C. W. Young, expenses	6 05
	11	J. P. Shoemaker, expenses	9 20
	12	Wm. Ball, expenses	2 50
	13	E. W. Rising, expenses	5 50
	14	A. O. Hyde, expenses	3 75
	15	J. Q. A. Burrington, expenses	4 60
	16	Franklin Wells, expenses	7 55
	17	Wm. H. Cobb, expenses	5 30
	18	D. W. Howard, expenses	10 85
	19	H. O. Hanford, expenses	3 15
	20	Geo. W. Phillips, expenses	4 10
	21	F. L. Reed, expenses	4 95
	22	Michigan Exchange Board of Com	136 00
	24	Abel Angel	7 85
Oct. 16.	104	American Express Co., Ex. on books and papers	3 15
			$258 35

PRESIDENT'S OFFICE.

June 2.	37	Wm. Chamberlain, expenses to Jackson	$20 80
Oct. 29.	130	Wm. Chamberlain, personal expenses	58 30
			$79 10

HORTICULTURAL SOCIETY.

Sept. 23.	59	S. M. Pearsall, Treasurer, allowance	$1,400 00

SECRETARY'S OFFICE.

Jan. 14.	1	J. C. Sterling, 3 months' salary	$250 00
April 11.	27	J. C. Sterling, 3 months' salary	250 00
July 28.	56	J. C. Sterling, 3 months' salary	250 00
Sept. 23.	76	W. K. West, Secy's clerk	32 45
	77	J. H. Hanford, Secy's clerk	13 40
	85	H. E. Wing, Secy's clerk	18 30
	86	C. J. Phillips, Secy's clerk	26 85
	87	F. Livermore, Secy's clerk	19 00
	88	J. E. Landon, Secy's clerk	31 35
	89	George E. Smith, Secy's clerk	30 00
	90	Hurd House, board of Secy and clerks	84 00
	91	Mrs. Chapin, board of clerks	41 50
Nov. 7.	217	J. C. Sterling, 3 months' salary	250 00
	229	J. M. Sterling, rent of office for 1887	50 00
			$1,345 85

TREASURER'S OFFICE.

Nov. 7.	203	A. J. Dean, clerk's pay roll	$158 50
	204	Hibbard House, board of treas. and clerks	43 00
	205	A. E. Dettweiler, board of clerks	27 33
	231	A. J. Dean, treasurer's bookkeeper	400 00
			$628 83

STATIONERY.

Oct. 16.	106	F. W. Meir, ink, paper, etc.	$12 60
Nov. 7.	219	G. E. Brown, stationery	3 90
			$16 50

SWITCHING.

1887.	No. Order.		
June 2.	36	M. C. R. R. Switching one car	$1 00

POSTAGE ACCOUNT.

June 1.	31	Jackson P. M. stamps for secy	$5 00
	32	Monroe, P. M., stamps for secy	5 00
	33	Monroe P. M., stamps for secy	5 00
July 27.	54	Monroe P. M., stamps for premium lists	10 00
	55	Monroe P. M., stamps for premium lists	8 00
Sept. 23.	62	Monroe P. M., stamps for secy	10 00
	63	Monroe P. M., stamps for secy	10 00
	64	Monroe P. M., stamps for posters	12 00
	65	Monroe P. M., stamps for comps	19 00
Oct. 16.	105	Monroe P. M., stamps for premium checks	7 00
Nov. 7.	206	Adrian P. M., stamps for chairman printing com.	5 00
			$96 00

PRINTING AND ADVERTISING.

Sept. 23.	61	Calvert Lithograph Co., lithographs and comps	$98 00
June 1.	35	M. D. Hamilton, letter heads, notices, etc	24 15
Sept. 23.	66	G. A. Raymond, newspaper advertisement	5 00
	68	Courier Lithograph Co., lithographs	13 85
	69	J. M. Jones & Co., lithographs	16 40
	70	Jas. O'Donnell, premium lists, etc	188 83
	71	Carlton & Van Antwerp, programmes, etc	116 20
	72	Democrat Printing Co., cards, circulars, etc	75 00
	73	M. D. Hamilton, posters and cards	9 25
	74	H. L. Hunt, lease book and blank bills	11 30
	75	Free Press Co., posters	161 00
	84	W. K. West, work for committee	18 00
Oct. 16.	106	J. C. Sterling, sundry trips	19 45
Nov. 7.	211	O. S. Gully, Bornman & Co., tickets	72 95
	212	Times and Expositor, letter heads, etc	94 30
	213	Mrs. G. F. Payne, entry and committee books	64 50
	220	Gibbons & Bro., publishing awards	75 00
			$1,068 18

GENERAL EXPENSE ACCOUNT.

Jan. 14.	23	B. J. Wood, cartage and labor	$3 00
Sept. 23.	67	Pay roll during fair	33 35
	78	Frank Little, Judge of election	3 00
	79	Robert Hewitt, Judge of election	3 00
Oct. 5.	100	W. M. Perkins, use of stove	1 00
Oct. 29.	116	Clark & Co., board of committee	148 35
	141	Jackson City Broom Co., 1 doz. brooms	3 00
	150	H. C. Ransom, rent of furniture	2

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1887.	No.	Order.	
Oct. 29.	151	J. H. Wortley, rent of ice chest	$5 00
	152	J. E. Woodruff, blacksmithing	1 60
Nov. 7.	208	J. R. Warner, Judge of election	8 00
	210	F. C. Miller, ¼ cord wood.	75
	220	J. C. Sterling, attending meetings, etc	38 62
	226	B. J. Wood, labor and hardware	4 81
			$250 48

BUSINESS COMMITTEE.

July 28.	57	A. O. Hyde, personal expenses	$13 05
Oct. 5.	101	Franklin Wells, expenses to Jackson, Sept. 12	7 90
	102	Franklin Wells, expenses to Jackson, July 30	5 90
Oct. 29.	110	Franklin Wells, expenses to Jackson, Aug. 30	7 75
	118	Franklin Wells, personal expenses	5 90
	120	A. O. Hyde, sundry trips to Jackson	25 20
	123	Franklin Wells, expenses to Jackson	4 55
	140	A. O. Hyde, expenses to Jackson	15 75
	144	J. C. Sharp, hotel bill	2 00
Oct. 29.	148	W. H. Gilbert, expenses as clerk	21 80
	149	W. H. Gilbert, expenses as clerk	5 52
Nov. 7.	225	W. H. Gilbert, clerk of committee	200 00
	233	Franklin Wells, expenses at meeting	8 20
	228	A. O. Hyde, expenses to Monroe	15 60
			$339 12

BUILDING ACCOUNT.

April 20.	28	B. J. Wood, repairing roofs	$27 75
April 29.	29	B. J. Wood, repairing roofs	24 00
May 9.	30	B. J. Wood, repairing roofs	43 00
Oct. 5.	93	Pay roll, labor week prior to fair	47 20
	96	Victor Sorg, repairing sky light	64 85
Oct. 29.	111	B. J. Wood, labor pay roll.	103 39
	118	B. J. Wood, labor pay roll.	137 28
	121	Victor Sorg, repairing sky light	44 50
	122	B. J. Wood, labor pay roll.	96 50
	143	B. J. Wood, labor pay roll.	35 75
	161	Glasgow Bros & Dack, canvass for carriage hall	13 40
Nov. 7.	216	Pay roll, labor pay roll	78 00
			$715 62

LUMBER ACCOUNT.

Sept. 23.	82	C. C. Pond, 400 ft. fencing @ $15.00	$6 00
Oct. 29.	109	C. C. Pond & Co., lumber account	56 79
	114	C. C. Pond & Co., lumber account	274 80
	115	Jackson, Filley & Co., lumber account	170 73
			$508 32

HARDWARE ACCOUNT.

Sept. 23.	80	Seib & Baier, tacks, twine, etc	$3 82
Oct. 29.	108	Barnard & Smith, nails	15 00
	132	O. H. McConnell, faucets	2 35
	157	Barnard & Smith, hardware	85 60
Nov. 7.	209	Barnard & Smith, 12 padlocks	2 50
			$109 27

TELEGRAPHING ACCOUNT.

1887.	No.	Order.	
Sept. 23.	81	W. U. Tel. Co., sundry messages	$4 28

LOCATING COMMITTEE.

April 11.	25	A. O. Hyde, expenses attending meeting	$17 00
	26	Franklin Wells, expenses attending meeting	20 00
June 2.	34	J. C. Sterling, expenses attending meeting	9 20
			$46 20

LANSING MEETING.

June 2.	38	J. Q. A. Burrington, expenses attending	$7 20
	39	Wm. Chamberlain, expenses attending	9 10
	40	D. W. Howard, expenses	11 30
	41	John Lessiter, expenses	5 00
	42	Geo. W. Phillips, expenses.	$10 10
	43	F. H. Smith, expenses	5 40
	44	E. W. Rising, expenses	3 50
	45	F. L. Reed, expenses	2 20
	46	A. F. Wood, expenses	65
	47	M. P. Anderson, expenses.	6 40
	48	Henry Fralick, expenses	4 30
	49	J. P. Shoemaker, expenses.	4 10
	50	Hudson House, board of committee	31 05
	51	J. C. Sterling, expenses	10 00
	52	H. O. Hanford, expenses	5 50
	53	W. J. Baxter, expenses	8 50
July 28.	57	A. O. Hyde, expenses	4 50
Oct. 29.	112	Franklin Wells, expenses	10 00
			$188 80

DECORATING.

Oct. 5.	95	Pay roll, decorating halls.	$9 00
	99	S. Bacon, flag pole	5 00
Oct. 29.	135	Alex. Brown, plants for main hall	25 00
			$39 00

GATES.

Nov. 7.	196	Wm. Ball, expenses of superintendent	$1 40
	197	Wm. Ball, board of superintendent	9 50
	198	Gate keeper's pay roll	118 60
	199	A. E. Dettweiler, board of gate keepers	28 33
	200	Mrs. Mary Penny, board of gate keepers	20 50
			$178 33

GROUNDS.

Oct. 5.	94	Pay roll labor on water pipe	$20 90
	96	Pay roll putting up field shafting	10 13
	97	E. Emmons, team work	45 00
Oct. 29.	137	E. G. Uptego, labor	3 00
	138	Thos. Maloney, labor	2 50
	142	R. E. Emmons, team work	182 25
	153	Pay roll, labor pay roll	25 25
	156	B. J. Wood, labor pay roll.	13 86
	156	Jackson, Filley & Co., 12 loads sawdust	15 00
Nov. 7.	227	E. J. Wood, labor	6 00
			$323 89

FORAGE.

July 28.	58	Frisbie & Brown, six bushels oats	$2 15
Oct. 29.	127	A. F. Wood, 50 tons hay	430 00
	128	Frank Maynard, hay and straw	583 15
Nov. 7.	182	E. W. Rising, expense as superintendent	27 50

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1887.	No. Order.		
Nov. 7.	183	E. W. Rising, paid help	$40 00
	184	E. W. Rising, expense as superintendent	14 00
	221	E. J. Farrand, oats	3 69
			$1,100 49

MUSIC.

Oct. 29.	159	G. E. Boos, band four days	$175 00

LIVERY ACCOUNT.

Oct. 29.	133	A. E. Sutton, livery for business committee	$13 00
	136	C. H. Vandercook, livery for committee	25 50
	146	Knapp & Sutton, hacks	8 00
			$46 50

MEAL TICKETS.

Oct. 29.	121	F. W. Baptist Church, 191 tickets	$63 66
	125	First Presbyterian Church 125 tickets	41 66
	126	First Baptist Church, 263 tickets	87 66
	145	B. J. Wood, 224 tickets	74 66
	160	N. W. Edgar. 59 tickets	19 66
			$287 80

EXPRESS.

Nov. 7.	207	U. S. Express Co., express on sundry packages	$4 05
	223	American Express Co., express to Monroe	38 84
			$42 89

HERD BOOKS.

Oct. 5.	92	American Shorthorn Assn, 4 volumes	$19 05
Nov. 7.	222	American Jersey Cattle Club, 10 volumes	19 65
			$38 70

POWER.

Sept. 23.	83	Wm. Eaton, engines for field shaft	$60 00
Oct. 29.	117	Hutchinson Mnfg. Co., power machinery hall	203 75
			$263 75

POLICE.

Oct. 29.	147	Police pay roll	$322 75
Nov. 7.	215	Police pay roll	3 00
			$325 75

SPECIAL ATTRACTION.

Sept. 33.	60	D. H. Harris, Mme. Marantette	$800 00

CHECK ROOM.

Oct. 29.	131	Clark Wilcox, checking baggage	$6 40

LADIES' COTTAGE.

Oct. 29.	154	Mrs. B. J. Wood, attending cottage	$15 00

RIBBONS AND BADGES.

Nov. 7.	214	J. V. De Foe, ribbons	$22 90

MEDALS AND DIPLOMAS.

Nov. 7.	218	Ira Mayhew & Co., filling diplomas	$3 40

BILL POSTERS.

Nov. 7.	224	J. E. Henry, posting bills	$94 95

GENERAL SUPERINTENDENT.

Nov. 2.	176	H. O. Hanford, expenses	$5 70
	177	H. O. Hanford, board	11 25
			$16 95

MARSHAL'S OFFICE.

1887.	No. Order.		
Oct. 26.	119	H. H. Hinds, expense and horse as assistant	$18 90
	139	Messrs. Hinds, Hodge and Kelly, assistants	66 90
Nov. 7.	202	H. H. Hinds, board of assistant	14 00
			$99 80

HORSE DEPARTMENT.

Nov. 2.	166	Geo. W. Phillips, expenses of assistant	$18 75
	167	Geo. W. Phillips, expenses of superintendent	8 70
	168	O. F. Smith, expenses as judge	10 00
	169	James Davidson, expenses as judge	10 25
	170	S. A. Colby, expenses as judge	10 00
	171	Benj. Taggart, expenses as judge	10 00
	172	C. W. Bidleman, expenses as judge	5 25
			$72 95

CATTLE DEPARTMENT.

Nov. 7.	178	I.H. Butterfield, supt's. expenses and board	$21 00
	179	I. H. Butterfield, expenses of judges and Gaston Phillips	32 00
	180	F. H. Johnson, expense as judge	11 00
	181	T. Huston. expense as judge	33 50
			$97 50

SHEEP DEPARTMENT.

Oct. 16.	107	C. W. Pelham, board of judge	$7 50
	189	D. W. Howard, expenses of supt	19 15
	190	D. W. Howard, board of supt	14 00
			$4 65

SWINE DEPARTMENT.

Nov. 7.	194	John Lessiter, expense and board of supt	$19 40
	195	F. W. Grennel, expense of judge	10 05
			$29 45

POULTRY DEPARTMENT.

Nov. 2.	173	J. Q. A. Burrington, expense of supt	$12 00
	174	J. Q. A. Burrington, board of supt	15 00
	175	Ambron Purchase, expense of judge	20 00
			$47 00

MANUFACTURERS' DEPARTMENT.

Nov. 2.	162	Henry Fralick, expense supt. and assistant	$43 85

MACHINERY DEPARTMENT.

Oct. 29.	129	John Gilbert, superintendent's expenses	$7 25

ART DEPARTMENT.

Oct. 29.	134	Chas. Cass, labor in art hall	$11 62
Nov. 2.	164	W. J. Baxter, expense and board supt	21 25
	165	C. R. Hathaway, expense of judge	12 50
			$45 37

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AGRICULTURAL DEPARTMENT.

1887.	No. Order.		
Nov.	7. 187	A. F. Wood, expense of supt.	$2 40

IMPLEMENT DEPARTMENT.

Nov.	7. 201	C. W. Young, expense and board of supt.	$36 75

VEHICLE DEPARTMENT.

Jan.	14. 2	F. L. Reed, supt. expenses, fair 1886	$5 40

MUSIC DEPARTMENT.

Nov.	7. 191	M. P. Anderson, expense of supt.	$21 85
	192	M. P. Anderson, board of supt.	22 25
			$44 10

NEEDLEWORK DEPARTMENT.

Oct.	29. 158	Miss Brow, expense of assistant supt.	$14 15
Nov.	7. 198	Miss Brow, board of assistant supt	16 00
			$30 15

MISCELLANEOUS DEPARTMENT.

Nov.	7. 188	Franklin Wells, expense of supt.	$5 60

HONEY AND BEE DEPARTMENT.

Nov.	7. 185	F. H. Smith, expenses of supt.	$4 00
	186	F. H. Smith, board of supt	9 00
			$13 00

DAIRY DEPARTMENT.

Nov.	2. 162	J. P. Shoemaker, expense of supt.	$4 95

BOOTHS AND SHOWS.

Dec.	7. 232	To 960 tickets to booth renters	$4 80

SUMMARY STATEMENT, 1887.

Winter meeting	$285 35
Postage account	96 00
Secretary's office	1,345 85
Printing and advertising	1,063 18
General expense account	250 48
Business committee	339 12
President's office	79 10
Building account	715 62
Lumber account	508 32
Hardware account	109 27
Treasurer's office	628 83
Locating committee	46 20
Lansing meeting	138 80
Gates	178 33
Grounds	328 89
Decorating	89 00
Livery	46 50
Forage	1,100 49
Meal tickets	287 30
Stationery	16 50
Express	42 89
Herd books	88 70
Horticultural society	1,400 00
Power	263 75
Switching	1 00
Police	325 73
Special attraction	800 00
Telegraph	4 28
Check room	6 40
Ladies' cottage	15 00
Music	175 00
Ribbons and badges	22 90
Medals and diplomas	3 40
Bill posters	94 95
General superintendent	16 95
Marshal's office	$99 80
Horse department	72 95
Cattle department	97 50
Sheep department	40 65
Swine department	29 45
Poultry department	47 00
Manufacturers' department	43 85
Machinery department	7 25
Art department	45 37
Agricultural department	2 40
Implement department	36 75
Vehicles department	5 40
Music department	44 10
Needlework department	30 15
Bee and honey department	13 00
Dairy department	4 95
Miscellaneous department	5 60
Booths and shows	480 00
	$11,888 27

MONEY PAID TREASURER BY THE BUSINESS COMMITTEE.

Amount received from booth leases	$2,124 50
Amount received from check room	54 70
Jackson City subscription	1,500 00
	$3,679 20

MONEY RECEIVED BY BUSINESS COMMITTEE FOR BOOTH RENTALS.

1887.	No.			Tickets issued.
Sept.	2.	1	Ladies First Baptist Church	$168 00	84
		2	Presbyterian Society	100 00	49
	3.	3	Free Baptist Church	96 00	48
		4	S. R. Edwards	28 00	14
		5	William West	40 00	20
		6	Russo & Forsch	48 00	24
		7	M. E. Bartlett	125 00	62
	7.	8	N. W. Edgar	120 00	60
	9.	9	H. Johnson	40 00	20
	10.	10	Eby & Forsythe	40 00	20
	12.	11	M. O. Hallorn	8 00	
		12	S. A. Hickman	27 50	13
	13.	13	Chambers & Scott	7 00	4
	15.	14	B. H. Stoddard	26 00	7
		15	B. T. Smithson	40 00	20
	16.	16	Joe Pease	12 00	6
		17	F. L. Whitney	16 00	8
		18	Hurson & Post	60 00	30
	17.	19	Patrick Murray	28 00	14
		20	G. W. Hammond	50 00	24
		21	James A. Wilson	32 00	16
		22	J. M. Seward	100 00	50
	19.	23	Phil. Milligan	150 00	75
		24	Chas. Watson	9 00	4
		25	F. M. Teller	24 00	12
		26	Homer Delamatter	7 50	3
		27	Joe Horn	10 00	5
		28	J. F. Lungabarde	15 00	7
		29	"Doct." J. Snyder	40 00	20
		30	J. Cortwright	15 00	7
		31	M. Mecheld	10 00	5
		32	Noble & Foster	40 00	20
		33	J. M. Robertson	6 00	3
		34	W. H. Wilson	10 00	4
		35	Andrew Lava	16 00	8
		36	J. F. Miller	21 00	10
		37	Goodrich & Co.	25 00	12
		38	Geo. Peach	12 00	6
		39	James Hoagland	12 00	6
		40	Fred Marsh	9 00	4
		41	J. Linton	6 00	3
		42	George Eldred	12 00	6
		43	Jno. Faulkner	16 00	7
		44	G. A. Ferguson	24 00	12
		45	Mrs. Schoinfield	21 00	12
		46	Andrew Miller	25 00	12
		47	Jewitt Williams	20 00	10
		48	E. W. Bert	1 00	
		49	H. B. Horton	25 00	12
	20.	50	H. C. Cutler	6 00	3
		51	L. F. Butler	10 00	5
		52	J. H. Bailey	9 00	4

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MONEY FOR BOOTH RENTALS.—*Continued.*

				Tickets issued.
20.	53	E. J. Hall	$9 00	4
	54	S. Hickman	30 00	15
	55	E. Fisher	6 00	3
	56	E. M. Stone	9 00	1
	57	R. E. James	5 00	2
	58	J. L. Mondshine	10 00	5
	59	Max Weinberg	10 00	
	60	M. Harris	10 00	5
	61	F. Boudrie	5 00	2
	62	Mrs. Wm. Prentice	6 00	3
21.	63	J. Fisher	10 00	5
	64	Hall & Hartshorn	27 00	13
	65	J. Dean	5 00	2
	66	L. M. Stevens	5 00	
	67	J. H. Speer	5 00	
	68	A. K. Draper	2 50	1
	69	Ben Bateson	6 00	2
22.	70	Ben Chow	5 00	2
23.	71	Battle of Gettysburg	125 00	
	72	Collected last day	19 00	
			$2,124 50	960

INVENTORY OF PROPERTY BELONGING TO THE MICHIGAN STATE AGRICULTURAL SOCIETY IN THE CITY OF JACKSON.

Articles Stored in Bee House.

400 Feet field shafting and couplings.
42 Bridge trees.
60 Feet shafting and bearings.
2 Iron band wheels.
1 Split band wheel.
1 Wooden band wheel.
1 Lot ¾ inch water pipe.
1 Lot 1 inch water pipe.
1 Lot ½ inch water pipe.
1 Smoke stack, flue cap and rods.
18 Lamp posts.
1 Pair shaft hangers and shaft.
2 Old ladders.
1 Old step ladder.
1 Old plow.
4 Round water tanks.
9 Long water tanks.
2 Square water tanks.
1 Grindstone.
10 Small wooden horses.
7 Posts for fountain fence.
1 Lot stall numbers.
1 Lot 4x4 oak stakes.
2 Lot railing, main hall.
5 Rolls wire for shafting cover.
1 Wheelbarrow.
1 Pump heads.
1 Rolls barbed wire.
1 Benches.
2 Land roller.
1 Road scraper.
2 Drag.

Stored in Main Hall.

1 Wagon and water tank.
2 Flag poles and pulleys.

Stored in Machinery Hall.

1 Line main shaft, couplings, boxes, etc.
1 Iron band wheel.
1 Wooden band wheel.

Stored in Business Committee Room.

1 Box glass jars (unopened).
1 Refrigerator.
11 Ticket boxes.
14 Mattresses and 6 pillows.
2 Old bedsteads.
3 Iron garden rakes.
1 Straw fork.
1 Bush hook.
2 Wooden rakes.
3 Sash and glass.
1 Scoop shovel.
1 Post augur.
2 Pitchforks.
1 Grub hoe.
1 Pickaxe.
2 Wooden signs.
1 Water pipe key.
1 Pair iron legs.
1 Hose cart and hose.
1 Piece hose and nozzle.
2 Watering pots.
1 Plantation bell.
2 Oil cans for machinery.
2 Whitewash brushes and pail.
3 Bundles department flags.
1 Mop.
2 Pieces small chain.
1 Hand saw.
1 Sledge hammer.
1 Carpenter's square.
1 Tape line.
1 Old ax, 1 new ax.
1 Branding iron.
1 Pair tackle blocks.
1 Roll rope.
3 Oil cans.
1 Old jug.
1 Log chain.
1 Old bushel basket.
1 Pair step ladders, new.
1 Water barrel.
1 Rubber belt.
27 Chairs.
10 Brooms.
8 Pigeon hole boxes.
1 Blackboard.
10 Tables.
1 Extension table and leaves.
1 Coil flag halyards.
1 Monkey wrench.
1 Lot tar paper.
2 Old step ladders.
1 Crow bar.
1 Tin pail.
2 Parts kegs nails.
2 Big oil cans.
1 Set stencil and brush.
1 Piece pump log.
2 Roll chicken coop wire.
1 Socket wrench for shafting.
1 Old tub.
1 Flag—"Ladies."

Articles Stored in Boxes.

1 Box—40 faucets and 24 drinking cups.
1 Box—23 comfortables.
10 Boxes street lamps.
1 Box—lamps and chimneys, 13 lanterns.
1 Box—pieces pipe, 35 cut-off valves.
1 Box—baggage checks.
1 Boxes mosquito bar for decorating.
45 Boxes horticultural society.
1 Box door rollers.
1 Box chicken cups.
1 Box banners including:
- 1 Machinery.
- 1 Large rooster.
- 1 Poultry department.
- 1 Agricultural.
- 1 Fine art hall.
- 2 Bee and honey hall.
- 1 Poultry hall.
- 1 Fruit hall.
- 1 Exposition hall.
- 1 Police station.
- 1 Apiary.
- 1 Baggage checked.
- 1 Dairy hall.
- 1 Secretary's office.
- 1 Farm and garden produce.
- 1 Miscellaneous hall.
- 1 Treasurer.
- 1 President's room.
- 1 Lot "sections."
- 1 Lunch.

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1 Manufactures.
1 Entrance.
1 Press room.
2 Crop Correspondents' headquarters.
2 Ticket office.
1 Children's department.
2 Streamers.
1 "Pomological hall" flag.
1 "State fair" flag.
1 "President" flag.
1 President's room.
1 Ladies' waiting room.
1 Ladies' room.
3 Small U. S. flags.
1 Large U. S. flag.
1 Box containing two castors.
1 Box marked "table linen," including:
8 Linen table cloths.
5 5-12 Doz. iron forks.
3 Carving knives.
1 Steel sharpener.
1 Pair scissors.
23 Tin tablespoons.
1 Doz. tin teaspoons.
5½ Doz. iron knives.
1 Large iron spoon.
4½ Doz. silver teaspoons.
3 Doz. silver forks.
3 Doz. silver knives.
2 Silver sugar tongs.
3 Silver pickle forks.
6 Silver butter knives.
10 Silver tablespoons.
4 Wooden mustard spoons.
19 Wiping towels.
19 Hand towels, linen.
1 Box marked "tinware," containing:
1 Scrub brush.
¾ Doz. wash basins.
4 Tin dippers.
2 Six (6) quart pans.
10 Tin plates.
2 Frying pans.
3 Dripping pans.
1 Cake pan.
1 Dust brush.
1 Box marked "tinware" containing:
1 Coffee boiler.
1 Tea boiler.
1 Clothes boiler.
3 Table servers.
3 Tin pails.
1 Dish pan.
1 Tea kettle.
3 Coffee pots.
3 Tin cups.
1 Silver teapot.

Respectfully submitted,
A. O. HYDE.
J. C. SHARP.
FRANKLIN WELLS.

Accepted and referred to Finance Committee.

REPORTS OF THE EXECUTIVE SUPERINTENDENTS.

DIVISION A—CATTLE.

To the President and Executive Committee of the Michigan State Agricultural Society:

The exhibit of cattle at the fair of 1887 was large in numbers and in quality very good. The number of entries in the several classes as found on the books of the secretary was as follows:

Class.	Entries.	Class	Entries.
1. Shorthorns	108	6. Holstein Friesian	88
2. Devons	47	7. Grades	47
3. Herefords	69	8. Fat	85
4. Jerseys	68		
5. Angus and Galloway	47	Total	509

Premiums offered, $2,965; premiums awarded, $2,907.

Limiting the entries by one owner to fifteen in one class decreased the number of animals without lessening the quality of the exhibit. I think it would be well to continue this rule.

There is a general demand by exhibitors for the restoration of the premium for bull and his get, and I consider it worthy a place in the list.

The improved list for fat cattle is bearing fruit in bringing out a fine class of cattle and strong competition. I consider this one of the most important classes.

Altogether there is a marked improvement in the cattle of the State in both beef and dairy breeds, due in some measure, I believe, to the competition invited by the prizes offered and awarded at the State Fair.

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In view of the importance of the dairy interest, it seems to me proper that more direct competition be invited for actual value or performance as dairy cattle.

I. H. BUTTERFIELD,

Superintendent.

Report accepted and referred to Committee on Rules and Premiums.

DIVISION B—HORSES.

To the President and Executive Committee of the Michigan State Agricultural Society:

The exhibition of horses at the State Fair of 1887 was very satisfactory and passed off very pleasantly.

There were entered upon the secretary's books 446 horses divided as follows:

Class.	Entries.	Offered.	Awarded.	Class.	Entries.	Offered.	Awarded.
9	7	$70 00	$70 00	16	14	$277 00	$95 00
10	15	287 00	101 00	17	28	176 00	131 00
11	110	493 00	423 00	18	68	289 00	189 00
12	85	219 00	190 00	19	28	330 00	270 00
13	33	145 00	142 00	20	28	330 00	270 00
14	24	135 00	100 00	21	8	220 00	180 00
15	44	237 00	137 00	22	19	210 00	160 00
Total					446	$3,368 00	$2,458 00

You will notice that in class 9 there are only two premiums offered. I recommend that in this class the premiums be the same as in class 10. Classes 11, 12, 13, 14, 15 and 16, no changes. Class 17 I recommend the adding of males the same as 15, and premiums the same as 15 and 16. In this matter I wish to have the Board give more than usual attention.

The time has come when the interest in this class is so great, it being the class most numerous and profitable of any class that farmers breed. At the winter meeting one year ago I moved to make this change. Several members said it was the custom to not encourage anything but thoroughbred males. I let it drop for the time, but have given it close attention since, and find it is not the case, and quite the reverse.

Now I ask the Board to give the classes close observation, and if so you will find that except classes 9 and 10, 16, 21 and 22, all the rest have been filled with grade horses for ten years and nothing else. That is, classes 11, 12, 13, 14, 17, 18, 19, 20 and a part of 22 are all grade. Gentlemen, I would like to say a word in explanation. There are a great many fine horses in the State not registered.

I will cite two cases, Champion, bred by J. P. Sanborn, of Port Huron, five crosses; the two young stallions bred and owned by C. F. Moore, of St. Clair, one five and the other six, while the horse that was awarded the first in class 15 in 1887 is only two crosses, as you will all see by his pedigree.

I recommend that the words standard bred be struck out in all classes except 12 and 13, and that they may be made one class.

Expense of the horse department at last fair $72.95.

GEO. W. PHILLIPS,

Superintendent.

Report accepted and referred to Committe on Rules and Premiums.

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DIVISION D—SWINE.

To the President and Executive Committee of the Michigan State Agricultural Society:

The total number of entries in this Division was 284; last year 317. The entries in each class were as follows: Berkshires, entries 48; amount offered, $134; awarded, $99. Essex, 55; amount offered, $134; amount awarded, $134. Suffolk and Small Yorks, 47 entries, $130 awarded. Poland Chinas, 80 entries, $134 awarded. Duroc Jersey, 23 entries, $122 awarded. Chester Whites and Large Yorks, 23 entries, $92 awarded. Fat Hogs, 13 entries; $31 offered, $31 awarded. Total amount offered in this Division $835, awarded, $732.

All of which is respectfully submitted.

JOHN LESSITER,
Superintendent.

Report accepted.

DIVISION E—POULTRY.

To the President and Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN,—The number of entries in Division E at the Fair of 1887 was 320, against 764 in 1886. The amount of premiums offered in this department was $361.50. Awards were made to the amount of $146.50.

The falling off in entries was due to various reasons; the principal of which were the holding, at the same time as the State Fair was held, of two large District Fairs, which were patronized by many of our old exhibitors; and to the cutting down the amount of premiums offered in the different classes, below the amount offered by most county societies.

The exhibition in most classes was meritorious, and in some the quality was of the highest character.

I would recommend that there be added to the list the following varieties, viz: White Plymouth Rocks, White Wyandottes, White Rose Comb Leghorns, Brown Rose Comb Leghorns, and Minorcas. All these are now well recognized and popular varieties and were represented in respectable numbers at our last Fair.

All of which is respectfully submitted.

J. Q. A. BURRINGTON,
Superintendent.

Report accepted and referred to Committee on Premiums.

DIVISION F—FARM AND GARDEN PRODUCTS.

To the President and Executive Committee of the Michigan State Agricultural Society:

Class 35, Grain and Seeds, there were 119 entries; $158.50 offered; $112 paid; considering the dry season, a creditable exhibition, the show of corn being the most deficient, no doubt caused by the drouth.

Class 36, Vegetables, there were 237 entries; $175.50 offered; $145.50 awarded. For the year it was a remarkable showing and attracted a good deal of interest. I think, perhaps, some varieties of potatoes, as single pecks, should be changed, as many varieties are becoming worthless and new varieties taking their place. I have a communication from D. B. Harrington, which the Premium List Committee might do well to consider.

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Class 37, display of Roots and Vegetables. There were 8 entries; $130 offered; $80 drawn.

Class 38, Flour, Meal and Feed. Of the $39 offered there was $11 paid, being a mistake in printing the premium list, it read 50 sacks, instead of 50 lb. sack, which probably hurt the show, and should be looked to so as not to occur again.

Whole number of entries in the department was 372, against 524 in 1886; $499 offered; awarded, $348.50.

A. F. WOOD,
Superintendent.

Report accepted and referred to Committee on Premiums.

DIVISION G—DAIRY PRODUCTS.

To the President and Executive Committee of the Michigan State Agricultural Society:

The whole number of entries in Division G was 126, as against 115 for 1886, showing a slight gain.

In Class 39, 63 entries; premiums offered, $85; awarded, $55.

Class 40, 56 entries; premiums offered, $95; awarded, $66.

Class 41, 7 entries; no premiums.

Total premiums offered $180; awarded, $121.

The entries were all good of their kind—the department well filled except cheese—there were no entries of cheese, which can only be attributed to want of interest in showing their goods or their entire independence of this mode of advertising, so much sought by other manufacturers. The dairy implement department was well filled and attracted much attention; the premium list seemed satisfactory. I would recommend that the number of cheese be six instead of ten, and that two instead of three loaves of bread be called for.

Respectfully submitted,
J. P. SHOEMAKER,
Snperintendent.

Report accepted and referred to Committee on Premiums.

DIVISION H—BEES AND HONEY.

To the President and Executive Committee of the Michigan State Agricultural Society:

At our last State Fair there was what I considered a very fine exhibit. Having given but very little attention to this industry since a boy, I was very much surprised with the improvements over the old methods for the production of honey—that purest and most delicious of all sweets. In this department there were twelve exhibitors. One hundred and sixty-four entries. Premiums offered amounted to $266. Premiums awarded $266. You will notice that the number of individual exhibitors was small, but that they were successful in capturing all the money offered in that department. I found the exhibitors, without an exception, to be gentlemen, congenial and obliging; ready to render any assistance they could in assisting the Superintendent to get the bee-house in readiness for the exhibits, which was highly appreciated by me, as the building presented a very uninviting appearance when the exhibits commenced to arrive. If the Society should ever be so fortunate as to make a permanent location, I would recmend that as soon as practicable an inviting and sufficiently commodious building be erected for the accommodation of exhibitors in this department; not only for the

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accommodation of exhibitors, but visitors. For I believe if this industry receives the encouragement it ought from our society, that exhibits in this department are bound to become more and more attractive, and will be a material aid of inducing visitors to attend our State Fairs.

I would take this opportunity, Mr. President, to recommend that as Mr. Gard has again become a member of the Executive Committee that he be reinstated as Superintendent of this department, which I think would be most satisfactory to exhibitors in that line.

All of which is respectfully submitted.

F. HART SMITH.

Report accepted.

DIVISION J.—VEHICLES.

To the President and Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN—There was a very large exhibit in Division J at the last Fair, the number of entries being 299—the space allotted being entirely filled. The exhibitors in the main were satisfied with the accommodations, but expressed the hope that in the near future the Society would be able to furnish covered space with a good roof. The exhibits were very fine, showing to what excellence manufacturers in this department have attained.

Respectfully submitted,

F. L. REED,

Superintendent.

Report accepted.

DIVISION L—MANUFACTURED GOODS.

To the President and Executive Committee of the Michigan State Agricultural Society:

As Superintendent of Exposition Hall I respectfully make the following report on Fine Arts, Music, Needlework, Children's Department and General Manufactures:

The hall was in fair order, the roof, foundations, and floors had been much improved since last season. The building is old and somewhat dilapidated, but with a general disposition to make the best of the situation, there was no claim for damage or loss of goods.

The exhibition in this hall in the various departments was very large, of great variety, well selected and displayed, and most of them of utility in their lines of usefulness.

Some of the departments were crowded, but all were well and tastefully arranged and displayed. The exhibitors were generally well satisfied with their spaces, location, attention and awards.

As Superintendent of Division L, manufactured goods, I respectfully make the following report:

The regular exhibition in most of this department was very full and good, and of non-enumerated articles very large and attractive, and many of great practical utility. Whole number of entries, 124; whole amount of premiums offered, $431; amount awarded, regular, $231; discretionary, $3, and 2 diplomas.

Division L comprises classes 53 to 57 inclusive.

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In Class 52, Materials.—Two entries of wool, no exhibit; premiums offered $70; no awards except a discretionary premium of a diploma to Messrs Foot & Jenks for a very fine exhibit of their own manufacture of perfumery. This is a very important class, and if possible the premiums should be so arranged as to induce a large and competitive exhibit *especially of wool*, and a creditable exhibit of flax and other materials.

Class 53. Factory Made Goods.—Although on the recommendations of the Superintendent of this Department in 1885, the premiums offered in 1886, were $135, while none were offered in 1885, it still brought no exhibits worthy of mention, only $10 being awarded that year. In 1887 there were no premiums offered, no entries nor awards, while this class contains a large number of articles and kinds of goods which are manufactured in the State, many of which are known to be of superior quality of their kind; but are not exhibited. I would respectfully recommend that the Committee on Premium List give this class special consideration, and if possible make the inducement for their exhibition at our Fairs such as will bring out a large exhibit of our own State Factory made goods of various kinds, such as I am confident are produced in the State and for the credit of our manufacturers and the information of our people should be exhibited at our annual State Fairs.

Class 54. Articles of Dress.—No premiums offered in this class. Nine entries, a very fine exhibit and attractive display. A discretionary premium of a diploma was awarded P. H. Luton for a large exhibit and great variety of very attractive and valuable furs and robes.

Class 55. Articles of Leather and India Rubber.—The exhibit in this class was large and principally of good articles of their kind. The display of boots, shoes, and rubber goods was of great variety and mostly of substantial quality, and a nice and attractive exhibit of very fine goods for ladies and children. Number of entries 27, premiums offered $111, awarded $42.

Class 56. Articles of Furniture.—Display large and quality good. Number of entries 66, premiums offered $215, regular premiums awarded $192, discretionary premium awarded on a non-enumerated but a meritorious article of $8.

Class 57. Stoves, Iron Work and Ornamental Concrete Work.—Number of entries, 18; premiums offered, $35; no premiums awarded. While the number of entries in this class was not large, yet the display of all kinds of stoves, ranges, furnaces, floor tiles, mantels and various other articles of that kind of goods was large and of very good quality. There were no premiums offered on stoves, ranges or furnaces.

The premiums offered in this class were mostly on fancy iron and concrete ware, of which there was but a small exhibit and of no special merit. The course adopted some years ago by this Society to offer no premium on stoves, has resulted in no loss of exhibits by the manufacturers of these goods, nor of the interest manifested by the attendants at the Fair in their annual display.

There is a very large class of articles embraced in this division of manufactured goods which are annually exhibited at our Fairs, on which there is no premium offered; but many of the articles are valuable products to the manufacturers, and of great utility to the consumer, and I recommend that the present liberal policy be continued by this Society for their exhibition, by providing ample and proper room and all other reasonable facilities to such exhibitors in this department.

All of which is respectfully submitted.

HENRY FRALICK,
Superintendent.

Report accepted and referred to committee on Rules and Premiums.

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DIVISION N—ART.

To the Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN—In submitting my report of division N, at the State Fair, I am glad to be able to state that it was especially meritorious and gave evidence of increasing culture and taste in the department of Fine Arts.

This Society may congratulate itself that with the small inducements and limited premiums we are able to offer, we have been able from year to year to secure the exhibit of many new, rare and valuable paintings, many of them placed upon exhibition for the first time, and others of such wide celebrity and excellence as to be sought for exhibition in much more ambitious art galleries.

Efforts were made to secure some very large and valuable paintings, and if the Society were in possession of a suitable hall protected from dust and dampness, there would have been no difficulty in securing them, but the owners of paintings of such size, excellence and value, were unwilling to expose them to irreparable injury in the only hall we were able to furnish.

Should our Society ever secure a permanent home, and grounds and buildings at all commensurate with its wants and the great interests it has in charge, we may hope to obviate all such objections on the part of the owners of the most exquisite and valuable productions of art.

In the present financial condition of the Society, I will not venture to urge any increase in the amount of premium offered, though as a matter of fact, the seemingly large premiums offered for a collection of paintings is not sufficient to pay the actual expenses of the exhibitor, and in corresponding with various collectors of paintings in my efforts to secure such collections for the Fair, I was met with the reply in most instances, that "the premium offered did not justify the expense."

I trust the Committee will, if unable to increase the premiums, at least not diminish them.

Whole number entries in class 61, 159; premiums offered, $711; premiums awarded, $591; entries in class 62, 88; premiums offered, $104; premiums awarded, $87; entry in both classes, 247; premiums offered, $875; premiums awarded, $678.

Respectfully submitted.

W. J. BAXTER,
Superintendent.

The report accepted and referred to Committee on Premiums.

DIVISION P—MISCELLANEOUS.

To the President and Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN—The undersigned Superintendent of Division P, Miscellaneous Department, begs leave to report as follows:

The number of entries in class 68 was 28; in class 69, 48; class 70, 2; in all classes, 78. The previous year, 1886, the number of entries in all classes was 108. The premiums offered in class 68 was $90, one medal and one diploma. The premium awarded was $4, one medal and one diploma. The premiums offered in class 69 were $22; awarded $2. In class 70 no premiums awarded; aggregate amount of premiums awarded, $6, one medal and one diploma; for 1886 premiums aggregating $82 were awarded.

It will be seen from the foregoing report that by comparison with the previous year, 1886, the interest in this department has considerably fallen off. A few handsome ex-

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hibits entered in this department, found their way to other departments offering more attractive quarters and finer surroundings. The *outside* exhibits, which in former years have added much interest, were entirely wanting this year. I think of no suggestions to make different from those made in my report of last year.

All of which is respectfully submitted.

FRANKLIN WELLS,
Superintendent.

Report accepted.

Supt. Phillips reported upon the protest entered in September against the award of a premium to Mr. Hagelsmare, recommending that the protest be not sustained.

Report of Superintendent accepted and adopted.

Supt. Phillips then reported upon the protest entered against the stallion "Young Contest," upon the grounds that he was not registered, recommending that the protest be not sustained.

Upon motion the report was accepted and adopted.

President Chamberlain then introduced President-elect Hon. A. O. Hyde, who addressed the Committee as follows:

ADDRESS BY PRESIDENT HYDE.

Gentlemen of the Executive Committee of the Michigan State Agricultural Society:

For many years you have been interested in listening to well-digested, able, opening addresses, from your President, on the gathering of yourselves together for the purpose of holding what is known as the annual winter meeting of your committee. There are seasons for all things, and times for many changes. It may be well for you that a change has come. On the outset I will take for granted that you will give credit for the remarks which you are invited to listen to, on one point—that is their brevity. I will only tax your patience while a few practical matters are touched upon, more by way of calling attention to them than by introducing new modes or theories.

The Society we represent was incorporated by act of the Legislature in the month of March, 1849. When this Society was formed Michigan was comparatively new and undeveloped, the people were poor and the State incumbered by a heavy debt. During this interim Michigan has become one of the rich States of the Union. Her debts are paid, her credit established, and in all respects her standing at home and abroad is second to no other State. We will not undertake to say how much of the agricultural and manufacturing prosperity of the State and her people is attributable to the constant work of the State Society. But it is not presumption on our part to say that all intelligent people acknowledge this Society an important factor in that direction. The subject of permanent location for the Society's exhibition has been agitated from time to time. The question of the executive committee's authority to fix such location is now settled by an enabling act passed by the Legislature of 1887. It was of legitimate birth and put under guardian in due form, with an appropriation made by the State Legislature of $400, to be paid annually for five years, providing the Society held annual fairs, paid premiums, etc. From that time to the present this Society has been a tramp. In fact one of the first professional and most persistent tramps that ever visited the State—but never a vagabond. The long list of worthy, able men who have had its various interests in charge, have shown a

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self sacrifice of time and comfort seldom if ever equalled. The first fair held by this Society was held in Detroit in September, 1849, with a premium list amounting to $1,000. It was all competed for and all paid. It is almost 40 years since that first fair was held. There has been no intermission in the fairs of this Society during this long period. With the results of these fairs you, gentlemen of the committee, are familiar.

The Society never received any aid from the State after the first five years of its existence. Until within a few years the State Society has been kindly treated and patronized by the State at large. Lately, however, some other agricultural societies have been formed and operated whose mission seems to be, to some extent at least, antagonistic to the State Society. Even this appearance is much to be regretted, and cannot be looked upon as tending to cultivate that kind of feelings most conducive to the general interest of all concerned. It seems very desirable that so far as possible a multiplication of agricultural exhibits should not be held in the State at the same time. It certainly is not for the best interests of the various associations, and works great injustice to exhibitors. Exhibitions would be more complete if the fairs were held on different weeks. Large exhibitors in all departments could then make the circuit of all the larger associations with their stock, implements, etc.

Hon. J. C. Holmes, whose body was buried a few days ago, was the first secretary of the State Society. To the time of his death he remained an interested, staunch friend, never failing to visit us with pleasant face and cheerful word when circumstances would permit. The committee will undoubtedly take such action in regard to the life and death of Mr. Holmes as may seem appropriate. The question of the future of the State Horticultural Society in connection with State Society will have to be settled during present meeting. It is a question of importance and deserves careful consideration at your hands.

It is expected that the Committee on Rules will consider the time their own, that is necessary to give the important work intrusted to them careful thought, and so word or simplify our rules that but one construction can be made in applying them.

To the Committee on Premium List let me say we all appreciate the great work you have to do. They seem to have succeeded fairly well in giving satisfaction to those directly interested in a general way. We now find the department of horses in a somewhat mixed state. The difficulty seems to be among breeders and owners of breeding horses. One party claims that all roadster classes must be standard bred. Another party claims that horses should be judged on their merit as producers, not depending entirely for their reputation on some distant relative. We want all the animals of merit recognized as far as practicable in our premium list. We want to represent what we claim in the name of *our Society*, the State. I only refer to this matter as my attention has often been called to it by interested parties on both sides, having all confidence in the committees I have no doubt they will do what seems to be right towards all.

In the unavoidable hasty manner in which these few remarks have been thrown together important matters may have been overlooked to which your attention might have been called. This will in no way bar any member from introducing any business that properly belongs to this meeting to attend to. In conclusion, gentlemen, I trust our meeting may be pleasant, and the work done prove to have been well done in the interests they represent.

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Mr. Wells moved that the addresses of the retiring president and president elect be referred to a special committee of three to recommend a subdivision of subjects.

The motion prevailed and the chair appointed as such committee Messrs. Fralick, Sharp and Reed.

The committee then took a recess until 8.30 Tuesday morning.

J. C. STERLING,
Secretary.

SECOND DAY.

RUSSELL HOUSE, DETROIT,
Jan. 10, 1888.

The Committee resumed its session this morning, President Hyde in the chair.

The roll was called, and the following members answered to their names: President Hyde, Treasurer Dean, Messrs. Hanford, Ball, Lessiter, Cobb, Sharp, Fifield, Smith, Burrington, Wood, Shoemaker, J. P., Young, Butterfield, Watkins, Anderson, Wells, Phillips, Fralick, Chamberlain and the Secretary.

DIVISION D—SHEEP.

To the President and Members of the Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN,—The undersigned, Superintendent of Division C, Sheep, would respectfully report as follows:

Class 23, entries 92; class 24, entries 91; class 25, entries 22; class 26, entries 30; class 27, entries 127; class 28, entries 27; class 29, entries 48; class 30, entries 33; class 31, entries 33; class 32, entries 20. Total number of entries 523. Amount offered for premiums was $1,584. Awarded, $1,505.

I recommend giving the Lincoln Sheep class the same as other long wools, with same premiums.

All of which is respectfully submitted.

D. W. HOWARD,
Supt. Div. C.

Report accepted and referred to Committee on Premiums.

DIVISION M—MUSICAL INSTRUMENTS, ETC. DIVISION O—NEEDLE AND FANCY WORK. DIVISION Q—CHILDREN'S DEPARTMENT.

To the President and Executive Committee of the State Agricultural Society:

GENTLEMEN,—The number of entries in my department were as follows:

Division M.

Class 58—No. of entries	17	Premiums awarded	
" 59 " "	2	" "	
" 60 " "	2	" "	$2 00
Total number of entries	21	Total	$2 00

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Division O.

Class 63—No. of entries	21	Premiums awarded	$17 00
" 64 " "	72	" "	37 00
" 65 " "	145	" "	103 50
" 66 " "	92	" "	27 50
" 67 " "	26	" "	19 00
Total number of entries	356	Total	$204 00

All departments under my charge were well filled and the best of feeling prevailed. In Divison O I was assisted by Miss Brow, who so long and ably conducted the department. In the large number of articles on exhibition not one was lost, or not returned to the owner.

All of which is respectfully submitted.

M. P. ANDERSON,
Superintendent.

REPORT OF GENERAL SUPERINTENDENT.

To the President and Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN,—The General Superintendent has the pleasure of reporting a great success at the last Fair as an exhibition; that the several departments and classes were usually well filled, and managed by the Superintendents of each class to the satisfaction of exhibitors and patrons; that the soldiers' drill was particularly pleasing to the public, and general good order prevailed during the Fair. The usual rain on Thursday no doubt had something to do with its financial success, but all felt that the exhibition was equal to, if it did not excel, any State exhibition in the country. While the exhibition has been a success each and every year since the organization of this Society it seems to me the members of this Board have not the same encouragement for the financial success in the future that we have had in the past.

There is hardly an institution in the country, of whatever kind, that demands so much sacrifice of time, energy and brain work (with no corresponding reward), as the management of this institution calls for from us. There is no material accumulation resulting from it, only as its benefits affect the people at large, and it is no doubt the feeling that we are accomplishing some good in the world, that has caused the members of this Board to shoulder this great responsibility from year to year (with no backing from any responsible authority), that has accomplished such glorious results.

It seems to me that a State Society is not only desirable, but is actually needed, that the products of the *whole* State may be compared, but unless we have the allegiance and material support of the people, we cannot hope to succeed in the future as we have in the past. All the success of this Society has been attained without State, or other aid, but by the energy and perseverance of its Committee, and their support by the people. Local societies of considerable magnitude are springing up in different sections that claim that support, leaving the State Society a limited district that is interested in its success. These societies are worthy and ought to be sustained, but it is very questionable whether they can be at the expense of the State Society. Disorganize that, and the others fall with it. Some well digested plan should be developed if we hope to succeed in the future. A fraternal feeling should be encouraged between all the Societies and the usual energy put forth and perhaps *greater* economy practiced by this Society.

H. O. HANFORD,
General Superintendent.

Report accepted.

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DIVISION I—FARM IMPLEMENTS.

To the Members of the Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN,—In Division I, Farm Implements, there was a very fine exhibit, one greatly in excess of any former meeting, there being 273 entries in 1885, 393 entries as reported in 1886, and 875 in 1887.

The best of feeling prevailed on the part of exhibitors, and much interest was taken by visitors looking over the various "labor saving" implements on the grounds.

I know of no recommendations to offer further than those suggested in my report of last year.

All of which is respectfully submitted.

C. W. YOUNG,
Superintendent.

Report accepted.

Mr. Hyde tendered his resignation as a member of the Executive Committee, he having been elected President of the Society.

On motion the resignation was accepted, and Messrs. Fralick, Lessiter and Phillips were appointed a committee to nominate to fill vacancy.

The Committee reported the name of Mr. F. L. Reed, of Olivet.

The report was accepted, and Mr. Reed elected by a unanimous ballot.

President Hyde then announced the following Standing Committees:

On Rules—Messrs. Hanford, Wood and Fifield.

On Premiums—Messrs. Phillips, Ball, Sharp, Watkins, Butterfield, Young and Lessiter.

Mr. Ball, Supt. of Gates, reported that everything passed off quietly and pleasantly in his department. He had no recommendations to offer.

Mr. Sharp offered the following resolution:

Resolved, That the Premium List Committee be instructed to report a list of premiums to be offered by this Society, not to exceed $800 in amount, for Horticultural Department, the same to be under the charge of a superintendent appointed by the Society.

Which was adopted by the following vote:

Yeas—President Hyde, Messrs. Ball, Lessiter, Cobb, Sharp, Fifield, Reed, Smith, Burrington, Wood, Shoemaker, J. P. Young, Butterfield, Wells, Fralick and Chamberlain—16.

Nays—Messrs. Watkins, Phillips and the Secretary.

Mr. Chamberlain stated that the committee appointed to prepare a testimonial for Mr. Cobb did not understand their duty, and had offended Mr. Cobb, unintentionally.

Mr. Wells moved that the resolution be recommitted to the Committee.

Carried.

Upon motion adjourned until 2 o'clock P. M.

AFTERNOON SESSION.

The Executive Committee resumed its session at 2 o'clock P. M.

Roll called. Present: President Hyde, Treasurer Dean, Messrs. Hanford, Ball, Lessiter, Cobb, Sharp, Fifield, Reed, Smith, Burrington, Wood, Shoemaker, J. P., Young, Butterfield, Watkins, Anderson, Wells, Phillips, Fralick, Chamberlain and the Secretary.

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The Committee on President's Addresses reported as follows:

The Committee to whom was referred the addresses of the outgoing and incoming Presidents to recommend a subdivision of subjects, and their proper reference, beg leave to make the following report:

That so much of the address as refers to the rules, their changes and simplification, be referred to the Committee on Rules.

So much as refers to a change in premiums and other exhibits, and opening of our Fair to competition of foreign stock, to the Committee on Premium List.

So much as refers to a permanent location of the State Fair, to a special committee of five.

So much as refers to the payment and salaries of the officers of this Society, to a special committee of three.

So much as refers to the State Horticultural Society, to a special committee of three, to confer with the officers or a like committee of said Society, who are expected to be in attendance at this meeting.

So much as refers to visiting the State Agricultural College, and holding of the next State Fair, to the Committee of the Whole.

So much as refers to special attractions to and at the State Fair, to the Business Committee.

So much as refers to the death of the Hon. J. C. Holmes, the first secretary and the life long friend of this society, to a special commitee of three.

All of which is respectfully submitted.

HENRY FRALICK,
F. L. REED.
JNO. C. SHARP.

Report adopted, and the president announced committees as follows:

On that part of the addresses relative to salaries—Messrs. J. P. Shoemaker, M. P. Anderson and F. H. Smith.

On that part relative to State Horticultural Society—Messrs. H. O. Hanford, W. H. Cobb and J. Q. A. Burrington.

On that part relative to the death of Prof. J. C. Holmes—Messrs. Henry Fralick, Geo. W. Phillips and A. J. Dean.

The committee on testimonial to Mr. Cobb reported as follows:

Your committee, appointed under a former resolution of the Executive Committee, to prepare a suitable testimonial to Mr. W. H. Cobb, having already reported by resolution which was adopted at the last winter meeting, are at a loss to know what further to do, and report this fact back to the Executive Committee.

WM. CHAMBERLAIN.
A. J. DEAN.

Mr. Sharp moved that the committee be instructed to prepare a suitable testimonial, not to exceed $100 in cost.

It was moved to amend by substituting $50 for $100.

The amendment was lost.

The ayes and nays were then called on Mr. Sharp's motion, and the motion carried by the following vote:

Yeas—Treasurer Dean, Messrs. Sharp, Fifield, Shoemaker, J. P., Butterfield, Watkins, Anderson, Wells, Phillips, Fralick and Chamberlain—11.

Nays—Messrs. Hanford, Ball, Lessiter, Burrington and Young—5.

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Mr. Ball moved that a committee be appointed to prepare a suitable testimonial for Mr. Hyde, retiring chairman of the Business Committee.

The motion prevailed, and Messrs. Ball and Sharp appointed as such committee.

Upon motion, adjourned until 7 o'clock P. M.

EVENING SESSION.

The committee resumed its session at 7 o'clock, as per adjournment.

Roll called.

Present, President Hyde, Treasurer Dean, Messrs. Rising, Hanford, Ball, Lessiter, Cobb, Sharp, Fifield, Reed, Smith, Burrington, Wood, Shoemaker, J. P., Young, Butterfield, Watkins, Anderson, Wells, Phillips, Fralick, Chamberlain and the Secretary.

The committee on that part of President's address relative to salaries reported as follows:

To the President and Executive Committee:

Your committee to whom was referred so much of the President's address as referred to salaries beg leave to report:

That, taking into consideration the financial condition of the Society, they deem it inexpedient to create any additional salaried officers. In addition we refer you to article 9 of the constitution.

J. P. SHOEMAKER.
F. HART SMITH.
M. P. ANDERSON.

Report accepted.

The Committee on Finance then submitted the following:

To the President and Executive Committee of the Micnigan State Agricultural Society:

GENTLEMEN,—Your committee, to whom was referred the reports of the Secretary, Treasurer and Business Committee, would say that they have made a careful examination of all the vouchers, stubs and books, and find that their reports made to this Society are correct.

All of which is respectfully submitted.

M. P. ANDERSON,
FRANKLIN WELLS,
Finance Committee.

Accepted and adopted.

The committee appointed at the September meeting to prepare suitable resolutions upon the death of ex-Presidents Bayley and Griggs, reported as follows:

Whereas, Since our last annual meeting two of our ex-presidents, who were *ex-officio* members of the Executive Committee, James Bayley, of Oakland county, and George W. Griggs, of Kent county, have been removed by death; and

Whereas, We desire to place upon record some expression of our general regard and friendship, and of our obligation to them for their long, earnest and efficient labors and efforts on behalf of the Michigan State Agricultural Society, and the great interests it endeavors to promote; therefore,

Resolved, That in the death of ex-Presidents James Bayley and George W. Griggs, this committee has lost two valued associates and friends; this Society two wise sup-

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porters and counselors, and the farmers and mechanics of Michigan two of their trusted representatives.

Resolved, That we sympathize with the family and friends of our deceased associates and hereby tender to them our sincere condolence, and the assurance of our respect and esteem.

W. J. BAXTER,
M. SHOEMAKER,
I. H. BUTTERFIELD,
Committee.

Adopted and ordered spread upon the minutes.

The report of the Horticultural Department was received and placed on file.

Upon motion, adjourned until 9 o'clock Wednesday morning.

THIRD DAY.

RUSSELL HOUSE, DETROIT,
January 11, 1888.

The Committee was called to order at 9 o'clock A. M, President Hyde in the chair.

Roll called, and the following named gentlemen answered to their names: President Hyde, Treasurer Dean, Messrs. Rising, Hanford, Ball, Lessiter, Cobb, Sharp, Fifield, Reed, Smith, Burrington, Wood, Shoemaker, J. P., Gard, Young, Butterfield, Watkins, Anderson, Wells, Phillips, Fralick, Chamberlain, and the Secretary.

Mr. Butterfield moved that the annual Fair for 1888 be held commencing September 17, and continuing five days.

Mr. Ball moved to amend by commencing September 10.

After a lengthy discussion the motion as amended was carried.

The Committee voted a recess until 2 o'clock P. M.

AFTERNOON SESSION.

The Executive Committee resumed its session at 2 o'clock P. M.

Committees were not ready to report, and a recess was taken until 3 o'clock P. M.

3 O'CLOCK.

The Committee on Conference with a Committee from the State Horticultural Society reported as follows:

Your committee appointed to confer with a like committee from the Horticultural Society, would respectfully report that we have met a member of that committee, to whom was made the following proposition, viz.:

This Society to pay the premiums of the Horticultural Society to the amount of $800, and in addition to pay the necessary expenses of two members of their Board; or, if necessary, three, to take care of their exhibit.

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On the part of the Horticultural Society it was desired that the above proposition should be held over until after a meeting of their Society, which will be held about the 25th of this month, and they will notify this Society immediately after said meeting.

H. O. HANFORD,
W. H. COBB,
J. Q. A. BURRINGTON.

Accepted and laid upon the table.

Mr. Anderson presented an invitation with the compliments of Mr. C. J. Whitney, to visit Mr. Whitney's new opera house this evening.

The invitation was accepted with thanks.

Mr. Wells invited the committee to visit the Agricultural College in June.

The invitation was accepted with thanks.

Recess until 6.30 o'clock P. M.

EVENING SESSION.

The committee reassembled at 6.30, as per adjournment.

The Secretary read a communication from Dr. W. J. Beal, asking the Society to appoint a delegate to the Michigan Forestry convention, to be held at Grand Rapids January 26 and 27, 1888.

Communication received, and upon motion of Mr. Ball Mr. Henry Fralick was chosen a delegate to represent the Society at said congress.

The committee appointed to prepare a testimonial for Mr. Cobb, reported that they had purchased a handsome marble clock, which they presented to Mr. Cobb, with the following remarks by Mr. Chamberlain:

MR. COBB,—In behalf of this Executive Committee I present you with this beautiful marble clock as a token of their appreciation for your services in connection with this Society.

We do not expect you will prize it so much for its intrinsic value as you will for a correct time-keeper. If you are careful to use the key to the situation at the proper time, you will find it an efficient aid to you in the years to come. You will not, either, regard it with satisfaction wholly because it does not disappoint you in giving the right time, but because it was presented by your fellow associates in this Society as an expression of their regard for you. As you look at the dial to give you the time in the future, it will often recall to you these times of the past.

I present it to you as a memento, that time will rectify the mistakes of the past with those who desire to do the right. But far more may you prize it because this clock, if properly cared for, will always do the right thing at the right time—as I trust may be the purpose of us all.

Mr. Cobb accepted the gift with thanks.

The report was accepted and the committee discharged.

The committee appointed to procure a suitable testimonial for Mr. Hyde, retiring chairman of the Business Committee, reported that they had purchased a handsome marble clock, which they presented to Mr. Hyde with appropriate remarks.

Mr. Hyde accepted the gift with thanks.

On motion the report was accepted and the committee discharged.

On motion the committee adjourned until 8.30 o'clock A. M., Thursday.

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FOURTH DAY.

RUSSELL HOUSE, DETROIT, *Jan. 12, 1888.*

The Executive Committee resumed its session this morning, President Hyde in the chair.

The roll was called, and the following gentlemen found present:

President Hyde, Treasurer Dean, Messrs. Rising, Hanford, Ball, Lessiter, Cobb, Sharp, Fifield, Reed, Smith, Wood, Shoemaker, J. P., Gard, Young, Butterfield, Watkins, Anderson, Wells, Phillips, Fralick, Chamberlain and the Secretary.

The report of the Committee on Conference with the State Horticultural Society was taken from the table, and after a lengthy discussion again tabled.

Mr. Sharp moved to reconsider the vote accepting the invitation to visit the Agricultural College.

The motion prevailed, and upon motion of Mr Sharp it was

Resolved, that the thanks of this Society be extended to the State Board of Agriculture for the kind invitation extended by it through Hon. Franklin Wells, President of said Board, to visit the Agricultural College in June, and the regret of this Committee that circumstances are such that an acceptance is not deemed advisable this year.

Mr. J. P. Shoemaker moved, and it was supported, that Mr. Franklin Wells be requested to report the condition of the College and College Farm at the annual meeting of the Committee.

Carried.

The matter of awarding a second premium to Mr. Hatch's stallion at the Fair of 1886 was taken up.

Mr. Sharp moved that said premium be awarded to Mr. Hatch.

The motion was lost by the following vote.

Yeas—Messrs. Sharp, Reed, Shoemaker, J. P., and Gard—4.

Nays—Messrs. Rising, Hanford, Ball, Lessiter, Cobb, Fifield, Smith, Wood, Young, Butterfield, Watkins, Phillips, Fralick, Chamberlain, President Hyde, Treasurer Dean, and the Secretary—17.

Voted a recess until 2 o'clock P. M.

AFTERNOON SESSION.

The Committee resumed business at the appointed time (2 o'clock P. M.)

The following communication was presented by Mr. Carlisle.

DETROIT, *Jan. 12, 1888.*

To the Executive Committee of the Michigan State Agricultural Society:

It is understood that under the provisions of an act of the Legislature, passed last winter, you are now in a position to determine upon a permanent location, and the following suggestions are presented for your consideration, in the hope that something practical may be formulated:

Suppose the Common Council of this city tender the use of that portion of Belle Isle Park lying along the shore of the American channel, say 1,000 feet from the bridge site, and extending to the point on Lake St. Clair, embracing from 60 to 100 acres. The expense of constructing docks, so that the large transit steamers can land laden with stock and articles designed for exhibition on the grounds, without breaking bulk at the

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railroad depots, and the construction of buildings and other improvements will, it is estimated, reach about $50,000.

The railway and ferry companies will, it is suggested, contribute at least one cent for every visitor to and from the exhibition, and other enterprising citizens will donate liberally to make up the sum required.

Among some of the advantages from locating in Detroit are that your buildings and property would have police protection whether used or not; the facilities for reaching the grounds would be ample, as there would be two lines of street railways and steamers on the river, and we think its location in Detroit will have a tendency to increase the interest of all parts of the State in its permanent success, and enlist the hearty co-operation of all the different societies, heretofore somewhat antagonizing, in promoting the prosperity and perpetuity of the old Agricultural Society of Michigan.

We are very respectfully yours,

F. A. BAKER.
F. W. HAYES.
W. K. MUIR.
HIRAM WALKER.
HENRY RUSSEL.
SIDNEY D. MILLER.
FRED. CARLISLE.

Upon motion the communication was laid upon the table, to be referred to the Committee on Permanent Location, to be appointed.

Mr. Sharp read a resolution adopted by the Jackson County Agricultural Society, offering the Society the free use of their grounds and buildings.

Upon motion laid upon the table.

The President appointed the Committee on Permanent Location as follows: Messrs. W. L. Webber, W. J. Baxter, M. Shoemaker, A. J. Dean, Wm. Chamberlain.

Upon motion the communication from Detroit citizens was taken from the table and referred to the Committee on Permanent Location.

The Committee appointed to prepare suitable resolutions upon the death of Prof. Holmes reported as follows:

To the President and Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN,—Your Special Committee appointed to prepare suitable resolutions relative to the death of Professor J. C. Holmes, the first Secretary of this Society, would respectfully recommend the following preamble and resolutions:

WHEREAS, Since our last meeting death has removed from his sphere of usefulness our friend and fellow worker, Prof. J. C. Holmes, who was the first Secretary and life-long friend of this Society; therefore,

Resolved, That in the death of our friend, Prof. J. C. Holmes, our Society has lost one of its earliest friends and promoters, an active, efficient and wise counsellor and co-laborer in the early and trying days of the Society; a much loved and respected citizen and friend, whose genial face and kindly greeting at our annual meetings we shall greatly miss, and whose vacant place for many of us who have been his associates for many years in this and other useful societies can never be filled.

Resolved, That we extend to the bereaved family our sincere condolence and sympathy,

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and assure them that as the beloved relatives of one whom we all loved they will ever have our affectionate remembrance.

Respectfully submitted,
HENRY FRALICK.
G. W. PHILLIPS.
A. J. DEAN.

Adopted by a rising vote.

President Hyde then announced the following Standing Committees, which were confirmed by the Committee:

Finance Committee—Messrs. M. P. Anderson, A. F. Wood and L. D. Watkins.

Business Committee—Messrs. Franklin Wells, J. C Sharp, and I. H. Butterfield.

Committee on Transportation—Messrs. W. H. Cobb, Eugene Fifield, and J. C. Sterling.

Committee on Reception—Messrs. Wm. Chamberlain, M. Shoemaker, and P. Parsons.

Committee on Programme—Messrs. Geo. W. Phillips, I. H. Butterfield, and J. C. Sharp.

Committee on Printing and Advertising—Messrs. A. J. Dean, J. C. Sterling, and Franklin Wells.

General Superintendent—Hon. William Chamberlain.

Chief Marshal—Mr. Eugene Fifield.

A recess until 4 o'clock P. M. was then taken.

The committee re-assembled at 4:30 o'clock P. M.

The Committee on premiums presented their report, fixing the premiums to be offered at the annual Fair for 1888.

It was moved and supported to take up the report by divisions.

Carried.

Division A reported same as last year, with the addition of a premium for a bull and four of his get.

Adopted.

Division B reported last year's list, with premiums added for stallions, two years, one year old, and stallion colt, brood mare, mare four, three, two, one year old, and mare colt in Class 9; and reducing the amount of premiums offered in Classes 19, 20 and 21.

The Committee offered the following resolution:

Resolved, That the sum of $2,500 be offered as speed premiums; to be divided into prizes, and the classes arranged by a committee to consist of A. J. Dean, Eugene Fifield and C. W. Young; the entrance to be ten per cent. of prizes, with not less than five entries in each class.

Adopted by the following vote:

Yeas—President Hyde, Treasurer Dean, Messrs. Hanford, Ball, Lessiter, Cobb, Sharp, Fifield, Shoemaker, J. P., Gard, Young, Butterfield, Anderson and Phillips—14.

Nays—Messrs. Reed, Smith, Wood, Watkins, Wells, Fralick and Chamberlain—7.

Division B adopted.

Division C reported list same as last year. Amount of premiums reduced in Class 25, and on Lambs in classes 23 and 24.

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Mr. Sharp moved to strike out Class 24.

The motion was lost by the following vote:

Yeas—Messrs. Sharp, Smith, Wood, Shoemaker, J. P., Gard, Watkins and Chamberlain—7.

Nays—President Hyde, Treasurer Dean, Messrs. Hanford, Ball, Lessiter, Cobb, Fifield, Reed, Young, Butterfield, Anderson, Wells, Phillips and Fralick—14.

Division C adopted.

A recess of one hour voted.

EVENING SESSION.

Committee resumed business at 7 o'clock P. M.

The Committee on Premiums report for Division D same list as last year.

Adopted.

Division E same as last year, with White Wyandottes, White Plymouth Rocks, Rose Comb Brown Leghorns, Rose Comb White Leghorns and Minorcas added.

Division F reported with few changes.

Adopted.

Division G reported with a few slight changes from last year's list.

Adopted.

Division H reported with a few premiums on implements stricken out.

Adopted.

Divisions I, J, K, L, M, N, and O reported the same as last year.

Adopted.

Division P reported same as last year, excepting Agricultural salt left out.

Adopted.

Division Q reported same as last year, and adopted.

Division R, "Horticultural Department," reported the list for that department in 1886, with a few additions.

Upon motion the report for Division R was laid on the table.

The Premium Committee offered the following:

WHEREAS, It is represented that the Norman Horse Association Register is unreliable, and that horses of doubtful breeding are registered therein; therefore

Resolved, That a committee of three be appointed by the President to investigate the subject and report at the next winter meeting.

Adopted, and the President appointed as such committee Messrs. Butterfield, Phillips and Smith.

The Committee on Rules then presented their report.

Mr. Young moved to strike out the words "Open to Michigan only," and insert "Open to the World."

After a lengthy discussion the motion was lost by the following vote:

Yeas—President Hyde, Treasurer Dean, Messrs. Cobb, Reed, Shoemaker, J. P., Young, Watkins, Fralick, Chamberlain, and the Secretary—10.

Nays—Messrs. Hanford, Ball, Lessiter, Fifield, Smith, Wood, Gard, Butterfield, Anderson, Wells and Phillips—11.

The report of the Committee to and including rules for Divisions A, B, C and D adopted.

The report of the Committee was adopted as a whole.

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Upon motion the report of the Premium Committee relating to Division R was taken from the table and adopted.

The report of the Committee on Rules for the Horticultural Department was upon motion adopted.

Upon motion of Mr. Sharp it was

Resolved, That the Business Committee be authorized to make such arrangements as they may deem expedient and desirable for a public sale at auction at the annual Fair any of the several breeds of Cattle, Horses, Sheep or Swine recognized in the Premium List, under such rules and regulations as they may prescribe.

Upon motion it was

Resolved, That the thanks of the Committee be and are hereby given to Mr. C. J. Whitney for courtesies extended to us on Wednesday evening.

Mr. Anderson offered the following, which was adopted by a unanimous vote:

WHEREAS, We have missed from this meeting the presence of our friend and associate, the Hon. Philo Parsons, and

WHEREAS, We learn with regret of Mr. Parsons' feeble health; therefore

Resolved, That we sympathize with our friend in his affliction, and sincerely hope he may be speedily restored to health and strength, and resume his accustomed place with us.

Mr. Cobb moved that the Secretary's salary for the year be fixed at $1,000 and the Treasurer be allowed $400 for a bookkeeper.

The question was divided and that part of the motion relative to the Secretary's salary, adopted.

The part of the question relative to an allowance to the Treasurer was adopted by the following vote:

Yeas—President Hyde, Messrs. Hanford, Ball, Lessiter, Cobb, Fifield, Shoemaker, J. P., Gard, Butterfield, Watkins, Anderson, Wells, Phillips, Fralick—14.

Nays—Mr. Chamberlain—1.

The report of the committee on conference with the Horticultural Society was taken from the table, and upon motion adopted.

Upon motion of Mr. Ball it was

Resolved, That if the State Horticultural Society accept the proposition offered by the State Agricultural Society, relating to the exhibits of the Pomological Society at the next State Fair, that the rules and regulations adopted by the State Agricultural Society at this meeting be so changed as may be satisfactory to the Pomological Society.

The Finance Committee reported that they had approved the bond of the Secretary.

Report accepted.

Upon motion of Mr. Fralick, the President, Treasurer, Secretary and Business and Transportation Committees were appointed the Locating Committee.

Mr. Chamberlain offered the following, which was adopted:

Resolved, That this Committee grant the use of the track on Friday afternoon, the last day of the fair, for the purpose of a competitive military drill between the military

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companies of the State, upon such conditions as shall be determined by the Business Commitee of this Society and the committee authorized to arrange for the drill; provided such arrangement is fully completed satisfactory to the Business Committee before the premium lists are printed.

Mr. Wells offered the following:

Resolved, That the Locating Committee be instructed to select Jackson as the place for holding the next fair, provided that a satisfactory contract can be made with responsible parties; that at least the sum of $1,500 shall be expended in the repair of the buildings thereon and new buildings, the putting of the said grounds in repair, and in putting the buildings in suitable condition for the holding of the fair; the expenditure of said money to be in a manner satisfactory to the Business Committee; the grounds to be free of rent and with water free.

Adopted by the following vote:

Yeas—Messrs. Ball, Lessiter, Sharp, Fifield, Reed, Smith, Gard, Young, Butterfield, Wells, Phillips and Chamberlain—12.

Nays—President Hyde, Messrs. Cobb, Wood, Shoemaker, J. P., Watkins, Anderson and Fralick—7.

The President announced the following superintendents:

Cattle—I. H. Butterfield.
Horses—G. W. Phillips.
Speed department—W. H. Cobb.
Sheep—D. W. Howard.
Swine—John Lessiter.
Poultry—J. Q. A. Burrington.
Miscellaneous—F. Hart Smith.
Art—W. J. Baxter.
Music—M. P. Anderson.
Children's Department—M. P. Anderson.
Needlework—L. D. Watkins.
Manufactures—Henry Fralick.
Agricultural—A. F. Wood.
Machinery—
Farm implements—C. W. Young and H. O. Hanford.
Dairy department—J. P. Shoemaker.
Vehicles—F. L. Reed.
Bees and honey—M. J. Gard.
Forage—E. W. Rising.
Horticultural—L. D. Watkins.
Gates—William Ball.

Adjourned *sine die*.

J. C. STERLING,
Secretary.

A. O. HYDE,
President.

MEETING OF LOCATING COMMITTEE.

HIBBARD HOUSE, JACKSON,
January 31, 1888.

The Locating Committee met at 2 o'clock P. M.

President Hyde in the chair.

Present: President Hyde, Treasurer Dean, Messrs. Wells, Sharp, Butterfield, and Secretary.

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The Jackson County Agricultural Society was represented by Messrs. M. H. Ray and Frank Maynard, who made the following proposition to the committee.

If the State Fair for 1888 is located at Jackson, the County Society will furnish their grounds and buildings free of rent, build new cattle stalls in place of the old ones on west side of grounds, five hundred feet of new stalls on north side of grounds, and give the State Society $400 to be expended in repairing buildings.

The proposition was accepted, contract drawn and signed.

Adjourned.

J. C. STERLING, *Secretary.* A. O. HYDE, *President.*

MEETINGS DURING FAIR, HELD SEPTEMBER 10–14, 1888.

HIBBARD HOUSE, JACKSON, *Monday, Sept. 10, 1888.*

The Executive Committee met at 7:30 P. M.

President Hyde in the chair.

Present: President Hyde, Treasurer Dean, Messrs. Ball, Sharp, Cobb, Rising, Butterfield, Lessiter, Shoemaker, J. P., Reed, Fifield, Smith, Howard, Hanford, Gard, Wood, Wells, Burrington, Watkins, Young, Phillips, Fralick, Chamberlain, and the Secretary.

The Secretary read a number of live stock entries received after time for closing entries in that department. Upon motion all late entries were laid on the table.

Dr. Haynes asked that horses starting in class 19 be given a record.

Mr. Sharp moved that the speed trials in class 19 be conducted in such a manner as to give the horses winning heats a record.

The motion was lost.

Upon motion, Messrs. W. J. G. Dean of Hanover, W. S. Wilcox, Adrian, and James B. Cobb, Kalamazoo, were chosen judges of election.

It was then moved and supported that the annual election be held in the building on the south side of the Fair grounds, now occupied by the Secretary of State. Carried.

J. C. STERLING, *Secretary.* A. O. HYDE, *President.*

HIBBARD HOUSE, JACKSON, *Tuesday, Sept. 11, 1888.*

Meeting of Executive Committee called to order at 7.30 P. M. by ex-President Fralick.

Present: Messrs. Fralick, Ball, Sharp, Howard, Hanford, Smith, Shoe-

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maker, J. P., Gard, Lessiter, Butterfield, Fifield, Reed, Cobb, Rising, Wood, Wells, Burrington, Young, Watkins, Phillips, Chamberlain, and the Secretary.

Minutes of previous meeting read and approved.

A protest against a stallion entered by Mr. Hart was read, and upon motion referred to Supt. Phillips.

Mr. Wood moved, and it was supported that the Treasurer be authorized to make a special rate for school children on Friday, and that Friday be known as "School Day." Carried.

Mr. Ball moved that one day be fixed upon to be known as "Jackson Day" and that the citizens of Jackson be invited to attend the Fair on that day. Carried.

Upon motion the Printing Committee were requested to have posters printed and posted advertising the "stock sale."

Supt. Howard stated that the time for receiving stock had elapsed, and that a lot of sheep shipped from the Buffalo Fair had not yet arrived, and asked for instructions.

Upon motion, referred to Supt. Howard with power to act.

Adjourned.

J. C. STERLING,
Secretary.

A. O. HYDE,
President.

HIBBARD HOUSE, JACKSON,
Wednesday, September 12, 1888.

Executive Committee met at 7.30 P. M. President Hyde in the chair. Quorum present.

Supt. Burrington, of Division E, Poultry, reported regular premiums awarded amounting to $159.50.

Accepted and adopted.

Supt. Gard, of Division H, Bees, Honey, etc., reported regular premiums awarded amounting to $177.

Accepted and adopted.

Assist. Supt. Miss Brow, of Division O., Needlework, reported regular premiums awarded $196; discretionary premiums recommended, $1. Total $197.

Accepted and adopted.

The same supt. reported for Division Q, Children's Department, regular premiums awarded amounting to $26; discretionary premiums recommended, $3. Total, $29.

Accepted and adopted.

Supt. Phillips, to whom the Hart protest was referred, reported recommending that the protest be not sustained.

Report accepted and adopted.

A protest from Mr. Bangs against horses entered as Cleveland Bays was read and upon motion referred to Supt. Phillips with power.

Adjourned.

A. O. HYDE,
President.

J. C. STERLING,
Secretary.

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MEETING OF THE SOCIETY.

HIBBARD HOUSE, JACKSON,
Wednesday, September 12, 1888.

Pursuant to published notice, the annual caucus of the Society was held at the Hibbard House this evening. Hon. Wm. Ball was chosen chairman and J. C. Sterling secretary.

It was moved and supported to proceed to an informal ballot for President. The motion prevailed. Messrs. John C. Sharp, Hodge and Hallock were appointed tellers.

It was moved and supported that each gentleman present show his certificate of membership or be otherwise identified as a member of the Society before voting. Carried.

First ballot there were 93 votes cast, of which T. W. Palmer received 43, John C. Sharp 27, A. O. Hyde 11, Wm. Ball 9, A. Styles 2, A. J. Brow 1.

Moved and supported that the ballot be declared unanimous and Mr. Palmer declared the nominee for President. Carried by a unanimous vote.

Mr. A. J. Dean was nominated for Treasurer by acclamation.

J. C. Sterling nominated Secretary by acclamation.

Upon motion Mr. Ball was renominated a member of the Executive Committee.

Mr. John C. Sharp renominated member of Executive Committee.

F. L. Reed renominated member of committee.

Moved and supported that Mr. N. J. Kelsey be nominated a member of the Executive Committee in place of Mr. Cobb. Carried.

Moved and supported to proceed to an informal ballot for a member in place of Mr. Rising. The motion prevailed and the ballot resulted as follows:

Votes cast, 104; Mr. Rising received 25, R. B. Carruss 25, Frank Maynard 32, H. R. Dewey 14, G. A. Woodford 5, R. B. Tanner 2, A. S. Donaldson 1.

First formal ballot, 112 votes cast. For R. W. Gillett 28, R. B. Carruss 34, H. R. Dewey 48, F. Maynard 1, E. W. Rising 1.

Second formal ballot, 109 votes cast. For H. R. Dewey 44, R. B. Carruss 35, R. W. Gillett 27, E. W. Rising 3.

Upon motion Mr. H. R. Dewey was declared nominated.

Mr. I. H. Butterfield renominated by acclamation.

Mr. John Lessiter renominated by acclamation.

Mr. J. M. Turner renominated by acclamation.

Mr. J. P. Shoemaker renominated by acclamation.

Mr. F. Hart Smith renominated by acclamation.

Adjourned.

J. C. STERLING,
Secretary.

THURSDAY, *September 13, 1888.*

The committee met in the Hibbard House parlors at 7:30 P. M.

President Hyde in the chair.

Present—President Hyde, Treasurer Dean, Messrs. Ball, Sharp, Reed, Butterfield, Rising, Lessiter, Shoemaker, J. P., Smith, Fifield, Howard,

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Gard, Wood, Wells, Anderson, Burrington, Watkins, Young, Phillips, Fralick, Chamberlain, and Secretary.

Mr. Reed asked to be excused from further attendance.

Granted.

Superintendents reported as follows:

Supt. Butterfield, Division A, Cattle, regular premiums awarded $2,837. Discretionary recommended on Guernseys $10, total $2,847.

Accepted and adopted.

Supt. Howard, Division C, Sheep, regular premiums awarded $1,317.

Accepted and adopted.

Supt. Lessister, Division D, Swine, regular premiums awarded $707.

Accepted and adopted.

Supt. Wood, Division F, Farm and Garden Products, regular premiums $356.

Accepted and adopted.

Supt. Shoemaker, Division G, Dairy, regular premiums awarded, $113.

Accepted and adopted.

Supt. Fralick, Division L, Manufactured Goods, regular premiums awarded $141. Discretionary premiums recommended $20, total $161.

Accepted and adopted.

Ass't Supt. Henry S. Fralick, Division M, Musical Instruments, etc., regular premium awarded $2.

Accepted and adopted.

Ass't Supt. W. W. Bennet, Division N, Art, regular premiums awarded $689. Discretionary premiums recommended $38, total $727.

Accepted and adopted.

Supt. Smith, Division P, Miscellaneous, regular premiums awarded $28. Discretionary premiums recommended one diploma.

Accepted and adopted.

Supt. of Speed reported only two entries in Free-for-All Trot, race declared off. Five entries and four starters in 2:35 Class, and five entries and five starters in Michigan Horse Class.

Accepted.

Treasurer Dean reported gate receipts for Monday $30, Tuesday $286, Wednesday $3,979.75, Thursday $7,290.75. Total for four days, $11,586.50.

The report of the judges of election was then read as follows:

JACKSON, *Sept. 13, 1888.*

We, the undersigned, regularly constituted judges of election for the election of officers of the Michigan State Agricultural Society for 1888, having made a canvass of votes cast find the following named persons to have received for the offices indicated the number of votes shown by the figures placed opposite their respective names, viz:

For President, Thos. W. Palmer received..... 207
For Treasurer, A. J. Dean received..... 206
For Secretary, J. C. Sterling received..... 206
For members of the Executive Committee:
Wm. Ball received..... 207
John C. Sharp received..... 134
F. L. Reed received..... 206
N. J. Kelsey received..... 207
H. R. Dewey received..... 207

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I. H. Butterfield received 207
John Lessiter received 207
James M. Turner received 207
F. Hart Smith received 207
J. P. Shoemaker received 207
James A. Green received 69
R. W. Gillett received 5

The President, Treasurer and Secretary and the first ten members of the Executive Committee named having received the highest number of votes were elected.

Signed S. E. GRAVES,
L. H. IVES,
ROBT. L. HEWITT,
Judges of Election.

A. O. HYDE,
President.

Report accepted and approved.

Upon motion the Secretary was instructed to notify Mr. Palmer of his election.

Moved and supported that exhibitors be allowed to remove their stock and goods at 4 o'clock sun time. Carried.

Adjourned.

A. O. HYDE,
President.

J. C. STEBBINS,
Secretary.

HIBBARD HOUSE, JACKSON,
Friday, Sept. 14, 1888.

Committee met at 7.30 P. M.

President Hyde in the chair.

Quorum present.

Supt. Phillips, Division B, Horses, reported regular premiums amounting to $2,327.00.

Accepted and adopted.

Supt. Watkins, Division R, Horticulture, reported $393.50 regular premiums awarded.

Accepted and adopted.

Secretary of State Osmun reported that he had issued 126 complimentary tickets to crop correspondents.

Accepted and placed on file.

A protest against awards in Class 8, Fat Cattle, by A. P. Cooke, Esq., was read.

Not sustained.

Several protests against awards in Division R read.

Not sustained.

Mr. Wells moved, and it was supported, that the vacancy in Permanent Locating Committee be filled by the chair. The motion prevailed, and the chair appointed Mr. Wm. Ball.

A member of said committee, Mr. Sharp, moved that it is the sense of this

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committee that the committee on Permanent Location be requested to proceed to business at once. Carried.

Treasurer Dean reported total gate receipts for 1888 $12,595.95, for 1887 $13,806.05.

Accepted.

Mr. Butterfield moved that a committee be appointed to prepare and present to the Executive Committee at the winter meeting suitable resolutions upon the death of ex-President Baxter. The motion prevailed, and Messrs. Fralick, Phillips, and Butterfield, were appointed such committee.

Upon motion of Mr. Chamberlain, a committee was appointed to draft and present to the Executive Committee suitable resolutions upon the death of Mr. H. C. Sherwood. Committee, Messrs. Chamberlain, Wells, and Young.

A claim of Mr. A. E. Sutton for work on the track presented, and upon motion referred to the Business Committee.

Mr. Bangs withdrew his protest presented Wednesday evening.

Adjourned.

J. C. STERLING,
Secretary.

A. O. HYDE,
President.

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OFFICIAL LIST OF PREMIUMS AWARDED AT THE FORTIETH ANNUAL FAIR OF THE MICHIGAN STATE AGRICULTURAL SOCIETY, HELD AT JACKSON, SEPTEMBER 10, 11, 12, 13 AND 14, 1888.

DIVISION A—CATTLE.

CLASS 1—SHORTHORNS.

Best bull, 3 years old or over, John Lessiter, Cole	$20 00
2d do., Benj. Batchelor, Oceola Center	15 00
3d do., Jno. C. Sharp, Jackson	10 00
Best bull, 2 years old, James M. Turner, Lansing	20 00
2d do., G. W. Inman, Ypsilanti	15 00
3d do., H. M. Darling, Arland	10 00
Best bull, 1 year old, A. M. Gawder, Adrian	15 00
Best bull calf, Jno. Lessiter, Cole	12 00
2d do., Benj. Batchelor, Oceola Center	8 00
3d do., A. P. Cook, Brooklyn	5 00
Best cow, 4 years old or over, Jas. M. Turner, Lansing	20 00
2d do., Jas. M. Turner, Lansing	15 00
3d do., Jno. Lessiter, Cole	10 00
Best cow, 3 years old, Jas. M. Turner, Lansing	20 00
2d do., Jno. Lessiter, Cole	15 00
3d do., Jas. M. Turner, Lansing	10 00
Best heifer, 2 years old, Jas. M. Turner, Lansing	20 00
2d do., Jas. M. Turner, Lansing	15 00
3d do., Jas. M. Turner, Lansing	10 00
Best yearling heifer, Jas. M. Turner, Lansing	15 00
2d do., Jno. C. Sharp, Jackson	10 00
3d do., Benj. Batchelor, Oceola Center	5 00
Best heifer calf, Raymond & Croman, Grass Lake	12 00
2d do., Jno. Lessiter, Cole	8 00
3d do., A. Lockwood, Marshall	5 00
Best herd, Jas. M. Turner, Lansing	35 00
2d do., Jno. Lessiter, Cole	25 00
3d do., Jno. C. Sharp, Jackson	20 00
Best bull and 4 of his get, Jno. Lessiter, Cole	25 00
2d do., Jno. C. Sharp, Jackson	15 00
3d do., A. M. Gawder, Adrian	10 00

RICHARD GIBSON, *Judge.*

CLASS 2—DEVONS.

Best bull, 3 years old or over, H. L. Carrier, Brookfield	$20 00
2d do., E. T. Doney, Jackson	15 00
3d do., R. G. Hart, Lapeer	10 00
Best bull, 1 year old, A. S. Munger, Bay City	15 00
Best bull calf, under 1 year, E. T. Doney, Jackson	12 00
Best cow, 4 years old, H. L. Carrier, Brookfield	20 00
2d do, E. T. Doney, Jackson	15 00
3d do., R. G. Hart, Lapeer	10 00

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Best cow, 3 years old, R. G. Hart, Lapeer	$20 00
2d do., R. G. Hart, Lapeer	15 00
3d do., H. L. Carrier, Brookfield	10 00
Best heifer, 2 years old, H. L. Carrier, Brookfield	20 00
2d do., E. T. Doney, Jackson	15 00
3d do., R. G. Hart, Lapeer	10 00
Best yearling heifer, R. G. Hart, Lapeer	15 00
2d do., H. L. Carrier, Brookfield	10 00
3d do., R. G. Hart, Lapeer	5 00
Best heifer calf, H. L. Carrier, Brookfield	12 00
2d do., E. T. Doney, Jackson	8 00

A. J. BURROWS, *Judge.*

CLASS 3—HEREFORDS.

Best bull, 3 years old or over, Merrill & Fifield, Bay City	$20 00
2d do., Merrill & Fifield, Bay City	15 00
3d do., Guy Henning, Wheatfield	10 00
Best bull, 1 year old, Merrill & Fifield, Bay City	15 00
2d do., A. S. Wolcott, Concord	10 00
3d do., Guy Henning, Wheatfield	5 00
Best bull calf, under 1 year, Merrill & Fifield, Bay City	12 00
2d do., Merrill & Fifield, Bay City	8 00
3d do., A. S. Wolcott, Concord	5 00
Best cow, 4 years old or over, Merrill & Fifield, Bay City	20 00
2d do., Merrill & Fifield, Bay City	15 00
3d do., Guy Henning, Wheatfield	10 00
Best cow, 3 years old, Merrill & Fifield, Bay City	20 00
2d do., Guy Henning, Wheatfield	15 00
3d do., Jas. M. Turner, Lansing	10 00
Best heifer, 2 years old, Merrill & Fifield, Bay City	20 00
2d do., Guy Henning, Wheatfield	15 00
3d do., Jas. M. Turner, Lansing	10 00
Best heifer, 1 year old, Merrill & Fifield, Bay City	15 00
2d do., Jas. M. Turner, Lansing	10 00
3d do., A. S Wolcott, Concord	5 00
Best heifer calf under 1 year old, Merrill & Fifield, Bay City	12 00
2d do., Guy Henning, Wheatfield	8 00
3d do., Merrill & Fifield, Bay City	5 00
Best herd of Devons, Merrill & Fifield, Bay City	35 00
2d do., Guy Henning, Wheatfield	25 00
3d do., Jas. M. Turner, Lansing	20 00

JNO. C. BERTRAM, *Judge,*
Bristol, Ill.

CLASS 4—JERSEYS.

Best bull, 3 years old or over, W. J. G. Dean, Hanover	$20 00
2d do., O. J. Bliss, Silver Creek	15 00
3d do., W. R. Montgomery, Jr., Hillsdale	10 00
Best bull, 2 years old, W. J. G. Dean, Hanover	20 00
2d do., Robt. Ball, Grand Rapids	15 00
Best bull, 1 year old, Cooley & Mister, Jackson	15 00
2d do., O. J. Bliss, Silver Creek	10 00
3d do., O. J. Bliss, Silver Creek	5 00
Bull calf under 1 year, W. J. G. Dean, Hanover	12 00
2d do., O. J. Bliss, Silver Creek	8 00
3d do., W. R. Montgomery, Jr., Hillsdale	5 00
Best cow, 4 years old or over, Isaac Marston, Detroit	20 00
2d do., G. B. & C. S. Smith, Eagle	15 00
3d do., W. J. G. Dean, Hanover	10 00
Best cow, 3 years old, Isaac Marston, Detroit	20 00
2d do., W. R. Montgomery, Jr., Hillsdale	15 00
3d do., O. J. Bliss, Silver Creek	10 00

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Best heifer, 2 years old, W. J. G. Dean, Hanover	$20 00
2d do., Isaac Marston, Detroit	15 00
3d do., W. R. Montgomery, Jr., Hillsdale	10 00
Best heifer, 1 year old, W. J. G. Dean, Hanover	15 00
2d do., W. R. Montgomery, Jr., Hillsdale	10 00
3d do., O. J. Bliss, Silver Creek	5 00
Best heifer calf under 1 year, W. R. Montgomery, Jr., Hillsdale	12 00
2d do., W. J. G. Dean, Hanover	8 00
3d do., W. R. Montgomery, Jr., Hillsdale	5 00
Best herd Jerseys, Isaac Marston, Detroit	35 00
2d do., W. R. Montgomery, Jr., Hillsdale	25 00
3d do., O. J. Bliss, Silver Creek	20 00
Best bull and 4 of his get, W. J. G. Dean, Hanover	20 00
2d do., O. J. Bliss, Silver Creek	15 00
3d do., G. B. & C. S. Smith, Eagle	10 00

ANDREW J. FISH, *Judge.*
Lima, Ohio.

CLASS 5—GALLOWAYS AND POLLED-ANGUS.

Best bull 3 years old or over, S. J. Murphy, Detroit	$20 00
2d do., Wm. P. Darrow, Jefferson	15 00
3d do., R. B. Caruss, St. Johns	10 00
Best bull, 1 year old, Wm. Keith, Pittsford	15 00
Best bull calf under one year, R. B. Caruss, St. Johns	12 00
2d do., Wm. P. Darrow, Jefferson	8 00
3d do., Wm. Keith, Pittsford	5 00
Best cow, 4 years old or over, R. P. Caruss, St. Johns	12 00
2d do., W. P. Darrow, Jefferson	8 00
3d do., Wm. Keith, Pittsford	5 00
Best cow, 3 years old, R. B. Caruss, St. Johns	20 00
2d do., R. G. Hart, Lapeer	15 00
3d do., Wm. P. Darrow, Jefferson	10 00
Best heifer, 2 years old, R. B. Caruss, St. Johns	20 00
2d do., Wm. Keith, Pittsford	15 00
3d do., R. G. Hart, Lapeer	10 00
Best yearling heifer, R. B. Caruss, St. Johns	15 00
2d do., R. G. Hart, Lapeer	10 00
3d do., Wm. Keith, Pittsford	5 00
Best heifer calf under one year, W. P. Darrow, Jefferson	12 00
2d do., R. B. Caruss, St. Johns	8 00
3d do., R. B. Caruss, St. Johns	5 00
Best herd Galloways, R. B. Caruss, St. Johns	35 00
2d do., R. G. Hart, Lapeer	25 00
3d do., Wm. Keith, Pittsford	20 00
Best bull and 4 of his get, R. B. Caruss, St. Johns	20 00
2d do., W. P. Darrow, Jefferson	15 00
3d do., Wm. Keith, Pittsford	10 00

CLASS 6—HOLSTEIN-FRIESIANS.

Best bull, 3 years or over, Wm. M. Sexton, Holly	$20 00
2d do., W. K. Sexton, Howell	15 00
3d do., Florens Eddy, Ionia	10 00
Best bull, 2 years old, H. L. Holmes, Holly	20 00
2d do., Bissell and Badsley, Jackson	15 00
3d do., Frank W. Park, Romeo	10 00
Best bull, 1 year old, Mills Bros., Ann Arbor	15 00
2d do., W. K. Sexton, Howell	10 00
3d do., Wm. M. Sexton, Holly	5 00
Best bull calf, under 1 year, Olds and Bacon, York	12 00
2d do., Frank W. Park, Romeo	8 00
3d do., Wm. M. Sexton, Holly	5 00
Best cow, 4 years or over, T. D. Seeley & Co., Bay City	20 00
2d do., W. K. Sexton, Howell	15 00
3d do., A. E. Riley, Walled Lake	10 00

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Best cow, 3 years old, J. W. Saliard, Romeo	$20 00
2nd do., W. K. Sexton, Howell	15 00
3d do., T. D. Seeley & Co., Bay City	10 00
Best heifer, 2 years old, A. E. Riley, Walled Lake	20 00
2d do., W. K. Sexton, Howell	15 00
3d do., T. D. Seeley & Co., Bay City	10 00
Best yearling heifer, Olds & Bacon, York	15 00
2d do., Wm. M. Sexton, Holly	10 00
3d do., Mills Bros., Ann Arbor	5 00
Best heifer calf under 1 year, J. W. Saliard, Romeo	12 00
2d do., Mills Bros., Ann Arbor	8 00
3d do., Mills Bros., Ann Arbor	5 00
Best herd Holsteins-Friesians, W. K. Sexton, Howell	35 00
2d do., A. E. Riley, Walled Lake	25 00
3d do., T. D. Seeley & Co., Bay City	20 00
Best bull and 4 of his get, Wm. M. Sexton, Holly	20 00
2d do., Mills Bros., Ann Arbor	15 00
3d do., Wm. K. Sexton, Howell	10 00

W. A. HAWLEY, *Judge.*

CLASS 7—GRADES.

Best cow, 4 years or over, A. P. Cook, Brooklyn	$20 00
2d do., David Miller, Clarkston	15 00
3d do., A. S. Munger, Bay City	10 00
Best cow, 3 years old, David Miller, Clarkston	20 00
2d do., A. S. Munger, Bay City	15 00
Best heifer, 2 years old, David Miller, Clarkston	20 00
2d do., A. P. Cook, Brooklyn	15 00
3d do., F. A. Townley, Tompkins	10 00
Best yearling heifer, John C. Sharp, Jackson	15 00
2d do., A. P. Cook, Brooklyn	10 00
3d do., David Miller, Clarkston	5 00
Best heifer calf, F. A. Townley, Tompkins	12 00
2d do., David Miller, Clarkston	8 00
3d do., John C. Sharp, Jackson	5 00
Best milch cow, 3 years or over, Mills Bros., Ann Arbor	15 00
2d do., H. H. Hinds, Stanton	10 00
3d do., A. S. Munger, Bay City	5 00

A. J. BURROWS,
W. K. SEXTON,
GUY HENNING,
Judges.

CLASS—8 FAT CATTLE.

Best steer, 3 years and under 4, H. H. Hinds, Stanton	$20 00
2d do., F. Hart Smith, Somerset	15 00
3d do., F. Hart Smith, Somerset	10 00
Best steer, 2 years and under 3, F. A. Townley, Tompkins	20 00
2d do., F. Hart Smith, Somerset	15 00
3d do., F. Hart Smith, Somerset	10 00
Best steer, 1 year and under 2, F. A. Townley, Tompkins	15 00
2d do., F. Hart Smith, Somerset	10 00
3d do., F. A. Townley, Tompkins	5 00
Best steer calf, 6 months and under 1 year, F. A. Townley, Tompkins	15 00
2d do., F. A. Townley, Tompkins	10 00
3d do., A. S. Wolcott, Concord	5 00
Best herd, 5 fat cattle, F. A. Townley, Tompkins	30 00
2d do., F. Hart Smith, Somerset	20 00
3d do., H. H. Hinds, Stanton	10 00
Best steer, 3 years and under 4, F. Hart Smith, Somerset	15 00
do., 2 do. 3, F. A. Townley, Tompkins	15 00
do., 1 do. 2, F. A. Townley, Tompkins	15 00

G. HOWARD ALLEN,
RICHARD CONLEY,
J. F. RUNDEL,
Judges.

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DIVISION B—HORSES.

CLASS 9—CLEVELAND BAY AND FRENCH COACH HORSES.

Best stallion, 4 years or over, John Powers, Homer	$20 00
2d do., Cleveland Bay Horse Co., Paw Paw	15 00
Best stallion, 3 years old, E. Helber, Saline	20 00
2d do., C. B. Truesdal, Wayne	15 00
Best stallion, 2 years old, Cleveland Bay Horse Co., Paw Paw	12 00
Best stallion, 1 year old, Cleveland Bay Horse Co., Paw Paw	10 00
2d do., John Powers, Homer	6 00
Best stallion colt, M. M. Kennedy, Jackson	7 00
2d do., John Powers, Homer	5 00
Best mare, 4 years or over, with foal, John Powers, Homer	20 00
2d do., John Powers, Homer	15 00
Best mare, 2 years old, Cleveland Bay Horse Co., Paw Paw	10 00
2d do., D. C. Blair, Napoleon	6 00
Best mare, 1 year old, John Powers, Homer	7 00
Best filly colt, Cleveland Bay Horse Co., Paw Paw	6 00

BENJ. TAGGART,
W. H. SMITH,
Judges.

CLASS 10—THOROUGHBREDS.

Best stallion, 4 years or over, H. H. Waters, Ovid	$20 00
Best stallion, 2 years old, Jno. W. Hicks, Horton	12 00
Best mare, 4 years or over, Thos. B. True, Rives Junction	15 00
2d do., Jno. W. Hicks, Horton	12 00

WILL N. ADAMS,
C. E. LOCKWOOD,
Judges.

CLASS 11—HORSES OF ALL WORK.

Best stallion, 4 years or over, Cleveland Bay Horse Co., Paw Paw	$20 00
2d do., Wm. Davison, Brooklyn	15 00
3d do., Davenport, Smith & Co., Grass Lake	10 00
Best stallion, 3 years old, Chas. Koenig, River Raisin	20 00
2d do., Cornelius Dancer, Horton	15 00
3d do., David Chapel, Parma	10 00
Best stallion, 2 years old, Cleveland Bay Horse Co., Paw Paw	12 00
2d do., A. H. Shurtz, Batavia	10 00
3d do., Cleveland Bay Horse Co., Paw Paw	8 00
Best stallion, 1 year old, J. E. Inman, Romeo	8 00
2d do., J. E. Inman, Romeo	5 00
3d do., Nelson Eldred, Battle Creek	3 00
Best mare, 4 years or over, with foal, Robt. Gould & Son, Ceresco	20 00
2d do., Jacob P. Sleight, Lansing	15 00
3d do., L. C. Hoyt, Jackson	10 00
Best mare, 3 years old, Jas. C. Deyo, Jackson	10 00
Best mare, 2 years old, Jas. C. Deyo, Jackson	8 00
2d do., Will N. Adams, Jackson	5 00
3d do., Thomas Maxwell, Lawton	3 00
Best mare, 1 year old, Wm. Davison, Brooklyn	7 00
2d do., J. E. Inman, Romeo	5 00
3d do., E. Booth, Brooklyn	3 00
Best filly colt, Robt. Gould & Son, Ceresco	5 00
2d do., M. M. Kennedy, Jackson	3 00
3d do., Thos. Maxwell, Lawton	2 00
Best gelding, 5 years or over, Davenport, Smith & Co., Grass Lake	15 00
2d do., W. F. Cowham, Jackson	10 00
3d do., Vaughn & Hall, Jackson	5 00
Best gelding, 4 years old, Davenport, Smith & Co., Grass Lake	12 00
2d do., Davenport, Smith & Co., Grass Lake	8 00

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Best gelding, 3 years old, Davenport, Smith & Co., Grass Lake	$10 00
Best gelding, 1 year old, Will N. Adams, Jackson	6 00
2d do., Jno. Stillwell, Lawton	4 00
2d best pair horses, 5 years or over, Thos. Maxwell, Lawton	15 00
3d do., Augustus Hicks, Albion	10 00
Best pair horses, 4 years old, A. P. Cook, Brooklyn	20 00
2d do., Davenport, Smith & Co., Grass Lake	12 00
3d do., Jas. C. Deyo, Jackson	8 00

JAS. DAVIDSON,
J. VANHOOSEN,
GEO. CRYDERMAN,
Judges.

CLASS 12—ROADSTERS.

Best stallion, 5 years or over, R. G. Hart, Lapeer	$25 00
2d do., Henry Brown, Battle Creek	20 00
3d do., Jas. C. Deyo, Jackson	10 00
Best stallion, 4 years old, C. C. Pond, Jackson	20 00
Best stallion, 3 years old. J. D. Shurtz, Bronson	20 00
2d do., Wm. Wellington, Springport	15 00
3d do., C. R. Durand, Jackson	10 00
Best mare, 5 years or over, Geo. Rowan, Jackson	15 00
2d do., Henry Brown, Battle Creek	10 00
3d do., A. E. Sutton, Jackson	5 00
Best mare or gelding, 4 years old, James C. Deyo, Jackson	12 00
2d do., W. F. Cowham, Jackson	8 00
3d do., Wm. Wellington, Springport	4 00
Best mare or gelding, 3 years old, Seaver & Dean, Hanover	10 00
2d do., H. D. Storms, Plainwell	6 00
3d do., L. C. Field, Mendon	4 00

BENJ. TAGGART,
WM. H. SMITH,
Judges.

CLASS 13—BREEDERS' STOCK.

Best stallion, 2 years old, Robert Gould & Son, Ceresco	$12 00
2d do., Milo Vannetter, Williamston	8 00
3d do., Dr. W. A. Gibson, Jackson	5 00
Best stallion, 1 year old, M. F. Rimes, Battle Creek	10 00
2d do., John Powers, Homer	6 00
3d do., Geo. B. King, Parma	4 00
Best stallion colt, M. F. Rimes, Battle Creek	7 00
2d do., Jas. C. Deyo, Jackson	5 00
3d do., Lewis Straw, Concord	3 00
Best mare, 4 years or over with foal, M. F. Rimes, Battle Creek	20 00
2d do., Chas. E. Strang, Bronson	15 00
3d do., Robert Gould & Son Ceresco	10 00
Best mare, 2 years old, Henry Brown, Battle Creek	8 00
2d do., Robert Gould & Son, Ceresco	5 00
3d do., Chas. E. Strang, Bronson	3 00
Best mare, 1 year old, S. G. & H. L. Bryant, Burr Oak	7 00
2d do., Robert Gould & Son, Ceresco	5 00
3d do., Dr. W. A. Gibson, Jackson	2 00
Best mare colt, Robert Gould & Son, Ceresco	5 00
2d do., Dr. W. A. Gibson, Jackson	3 00
3d do., Pitts Ray, Concord	2 00

JAMES DAVIDSON,
J. VANHOOSEN,
Judges.

CLASS 14—GENT'S DRIVING HORSES TO ROAD WAGON.

Best pair driving horses, Vaughn & Hall, Jackson	$20 00
2d do., F. B. Stockbridge, Kalamazoo	15 00
3d do., Jas. C. Deyo, Jackson	10 00

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Best mare or gelding, 5 years or over, C. R. Durand Jackson	$20 00
2d do., W. W. Hayward, Marshall	15 00
3d do., Edward Sutton, Parma	10 00
Best mare or gelding, 4 years old, Jas. C. Deyo, Jackson	20 00
2d do., H. C. Richardson, Sandstone	15 00

BENJ TAGGART,
WM. H. SMITH,
F. W. DICKEY,
Judges.

CLASS 15—CLYDESDALE OR ENGLISH SHIRE HORSES, REGISTERED.

Best stallion, 4 years or over, Jas. M. Turner, Lansing	$20 00
2d do., P. W. Lewis, Medina	15 00
3d do., C. B. Truesdal, Wayne	10 00
Best stallion, 3 years old, A. Phillips, Dansville	20 00
2d do., M. M. Kennedy, Jackson	12 00
Best stallion, 2 years old, E. G. Rust, Saginaw	10 00
2d do., Jas. M. Turner, Lansing	6 00
3d do., R. B. McQuistin, Saginaw	4 00
Best stallion, 1 year old, Jas. M. Turner, Lansing	8 00
Best stallion colt, Jas. M. Turner, Lansing	5 00
2d do., A. Phillips, Dansville	3 00
Best mare, 4 years or over, E. G. Rust, Saginaw	15 00
2d do., Jas. M. Turner, Lansing	12 00
3d do., Jas. M. Turner, Lansing	8 00
Best mare, 3 years old, Jas. M. Turner, Lansing	12 00
Best mare, 2 years old, E. G. Rust, Saginaw	10 00
Best mare, 1 year old, Jas. M. Turner, Lansing	8 00
2d do., Jas. M. Turner, Lansing	5 00
Best filly colt, Jas. M. Turner, Lansing	5 00

JAS. DAVIDSON,
J. VANHOOSEN,
GEO. CRYDERMAN,
Judges.

CLASS 16—PERCHERON FRENCH DRAFT HORSES, REGISTERED.

Best stallion, 4 years or over, Edmund Warner, Reading	$20 00
2d do., Thos. W. Palmer, Detroit	15 00
3d do., J. E. Inman, Romeo	10 00
Best stallion, 3 years old, R. G. Hart, Lapeer	20 00
2d do., A. H. Shurtz, Batavia	12 00
3d do., Adgate & David, Ionia	8 00
Best stallion, 2 years old, Thos. W. Palmer, Detroit	10 00
2d do., Thos. W. Palmer, Detroit	6 00
3d do., Jacob P. Sleight, Lansing	4 00
Best stallion, 1 year old, Thos. W. Palmer, Detroit	8 00
Best stallion colt, R. G. Hart, Lapeer	5 00
2d do., Jacob P. Sleight, Lansing	3 00
3d do., Jacob P. Sleight, Lansing	2 00
Best mare, 4 years or over, Thos. W. Palmer, Detroit	15 00
2d do., Jacob P. Sleight, Lansing	12 00
3d do., Thos. W. Palmer, Detroit	8 00
Best mare, 3 years old, R. G. Hart, Lapeer	12 00
2d do., Thos. W. Palmer, Detroit	8 00
3d do., Thos. W. Palmer, Detroit	5 00
Best mare, 2 years old, Thos. W. Palmer, Detroit	10 00
2d do., Thos. W. Palmer, Detroit	6 00
3d do., Jacob P. Sleight, Lansing	4 00
Best mare, 1 year old, Thos. W. Palmer, Detroit	8 00
2d do., Thos. W. Palmer, Detroit	5 00
3d do., Jacob P. Sleight, Lansing	3 00

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Best filly colt, Thos. W. Palmer, Detroit	$5 00
2d do., R. G. Hart, Lapeer	3 00

JAS. DAVIDSON,
J. VANHOOSEN,
GEO. CRYDERMAN,
Judges.

CLASS 17—DRAFT HORSES, PEDIGREES NOT REQUIRED.

Best mare, 4 years old or over, J. E. Inman, Romeo	$15 00
2d do., Jas. M. Turner, Lansing	12 00
3d do., Thos. Cross, Bangor	8 00
Best mare, 3 years old, R. G. Hart, Lapeer	12 00
2d do., Jacob P. Sleight, Lansing	8 00
Best mare or gelding, 2 years old, Jacob P. Sleight, Lansing	10 00
2d do., A. Phillips, Dansville	6 00
Best mare or gelding, 1 year old, Eli Fisk, Tompkins	8 00
2d do., Eli Fisk, Tompkins	5 00
3d do., Eli Fisk, Tompkins	3 00
Best colt, Jas. M. Turner, Lansing	5 00
2d do., J. E Inman, Romeo	3 00
3d do., Jas. M. Turner, Lansing	2 00

BENJ. D. TAGGART,
WM. H. SMITH,
Committee.

CLASS 18—CARRIAGE AND BUGGY HORSES.

Best pair matched horses, 16 hands or over, 5 years old or over, Mrs. S. A. Cooley, Jackson	$25 00
2d do., Wm. H. Withington, Jackson	20 00
3d do., Thos. Westren, Jackson	10 00
Best pair matched horses, 16 hands or over, 5 years old or over, Newell Morehouse, Albion	25 00
2d do., Jas. C. Deyo, Jackson	15 00
3d do., Davenport, Smith & Co., Grass Lake	10 00
Best pair matched horses, under 16 hands, 4 years old or over, Vaughn & Hall, Jackson	25 00
2d do., Davenport, Smith & Co., Grass Lake	15 00
3d do., R. E. Strong, Jackson	10 00
Best pair matched horses, 3 years old, Robt. Gould & Son, Ceresco	12 00
Best horse or mare, 4 years old or over, Albert Stiles, Jackson	12 00
2d do., D. D. Mitchell, Leslie	8 00
3d do., Chas Knickerbocker, Jackson	4 00
Best horse or mare, 3 years old, H. H. Waters, Ovid	10 00
2d do., Wm. Wellington, Springport	7 00
3d do., Jno. C. Sharp, Jackson	3 00

BENJ. D. TAGGART,
WM. H. SMITH,
F. W. DICKEY,
Judges.

CLASS 19—ROADSTER STALLIONS.

Best stallion, 5 years old or over, C. E. Ball, Dansville	$25 00
2d do., J. D. Shurtz, Bronson	20 00
3d do., H. V. Hughes, Saginaw	10 00
Best stallion, 4 years old, C. C. Pond, Jackson	20 00
2d do., Chas. E. Bennett, Jackson	15 00
3d do., Jno. Carey, Jackson	10 00
Best stallion, 3 years old, Farrell & Godfrey, Parma	20 00
2d do., Dr. Henry Haynes, Jackson	15 00
3d do., Benj. Buell, Bronson	10 00

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Best stallion, 2 years old, D. D. Mitchell, Leslie	$12 00
2d do., G. F. Hillhouse, Jackson	8 00
3d do., W. J. Bauer, Jackson	5 00

BENJ. D. TAGGART,
JAS. DAVIDSON,
GEO. CRYDERMAN,
Judges.

CLASS 20—ROADSTERS, MARES AND GELDINGS.

Best mare or gelding, 5 years old or over, Jas. C. Deyo, Jackson	$25 00
2d do., W. C. Walldorf, Monroe	20 00
3d do., L. Pike, Jackson	10 00
Best mare or gelding, 4 years old, W. H. Godfrey, No. Parma	20 00
2d do., Chas. E. Bennett, Jackson	15 00
Best mare or gelding, 3 years old, Clifton Short, Bronson	20 00
2d do., Farrell & Godfrey, Parma	15 00
3d do., H. D. Storms, Plainwell	10 00
Best mare or gelding, 2 years old, Jas. C. Deyo, Jackson	12 00
2d do., S. G. & H. L. Bryant, Burr Oak	8 00
3d do., L. C. Field, Mendon	5 00

B. D. TAGGART,
JAS. DAVIDSON,
GEO. CRYDERMAN,
Judges.

CLASS 21—THOROUGHBRED STALLIONS, MARES AND GELDINGS.

Best stallion, any age, P. B. Baker, Jerome	$15 00
Best mare or gelding, any age over 3 years, Chas. E. Bennett, Jackson	40 00
2d do., P. B. Baker, Jerome	20 00
3d do., P. B. Baker, Jerome	10 00

BENJ. TAGGART.
JAS. DAVIDSON,
GEO. CRYDERMAN,
Judges.

CLASS 22—SWEEPSTAKES FOR STALLIONS WITH FIVE COLTS OF HIS GET.

Best roadster stallion, Henry Brown, Battle Creek	$20 00
2d do., Dr. W. A. Gibson, Jackson	15 00
Best coach stallion, John Powers, Homer	20 00
2d do., M. M. Kennedy, Jackson	15 00
Best Clydesdale stallion, A. Phillips, Dansville	20 00
Best Percheron stallion, J. E. Inman, Romeo	20 00
2d do., Jacob P. Sleight, Lansing	15 00

BENJ. D. TAGGART,
J. VAN HOOSEN,
JAS. DAVIDSON,
A. E. SUTTON,
GEO. CRYDERMAN,
Judges.

DIVISION C. SHEEP.

CLASS 23—THOROUGHBRED AMERICAN MERINOS.

Best ram, 3 years or over, J. W. Hibbard, Bennington	$15 00
2d do., A. A. Wood, Saline	12 00
3d do., Fellows & Allen, Manchester	8 00
Best ram, 2 years old, A. A. Wood, Saline	15 00
2d do., Amos Parmenter, Vernon	12 00
3d do., R. W. Mills, Saline	8 00

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Best ram, 1 year old, N. A. Wood, Saline	$15 00
2d do., A. A. Wood, Saline	12 00
3d do., Amos Parmenter, Vernon	8 00
Best ram lamb, I. E. Wood, Saline	8 00
2d do., A. A. Wood, Saline	6 00
3d do., Benj. F. Batcheler, Oceola Centre	4 00
Best ewe, 3 years or over, A. A. Wood, Saline	15 00
2d do., C. M. Fellows, Manchester	12 00
3d do., N. A. Wood, Saline	8 00
Best ewe, 2 years old, C. M. Fellows, Manchester	15 00
2d do., A. A. Wood, Saline	12 00
3d do., R. W. Mills, Saline	8 00
Best ewe, 1 year old, A. A. Wood, Saline	15 00
2d do., J. W. Hibbard, Bennington	12 00
3d do., R. W. Mills, Saline	8 00
Best ewe lamb, Amos Parmenter, Vernon	8 00
2d do., Benj. F. Batcheler, Oceola Centre	6 00
3d do., A. A. Wood, Saline	4 00

T. C. NELSON,
J. E. HORNER,
C. E. LOCKWOOD,
Judges.

CLASS 24—THOROUGHBRED AMERICAN MERINOS, BRED AND OWNED IN MICHIGAN.

Best ram, 2 years or over, I. E. Wood, Saline	$15 00
2d do., F. M. Ottmar, Saline	12 00
3d do., Amos Parmenter, Vernon	8 00
Best ram, 1 year old, F. M. Ottmar, Saline	15 00
2d do., Amos Parmenter, Vernon	12 00
3d do., John Chilson, Hanover	8 00
Best ram lamb, A. A. Wood, Saline	8 00
2d do., A. A. Wood, Saline	6 00
3d do., Charles R. Parsons, Saline	4 00
Best ewe, 2 years or over, A. A. Wood, Saline	15 00
2d do., Raymond & Croman, Grass Lake	12 00
3d do., A. A. Wood, Saline	8 00
Best ewe, 1 year old, N. A. Wood, Saline	15 00
2d do., F. M. Ottmar, Saline	12 00
3d do., John Chilson, Hanover	8 00
Best ewe lamb, Benj. F. Batcheler, Oceola Centre	8 00
2d do., A. A. Wood, Saline	6 00
3d do., A. A. Wood, Saline	4 00

C. E. LOCKWOOD,
T. C. NELSON,
JOHN E. HORNER,
Judges.

CLASS 25—FINE WOOL GRADES.

Best ewe, 3 years or over, R. W. Mills, Saline	$6 00
2d do., Raymond & Croman, Grass Lake	4 00
3d do., R. W. Mills, Saline	2 00
Best ewe, 2 years old, R. W. Mills, Saline	6 00
2d do., Raymond and Croman, Grass Lake	4 00
3d do., J. W. Hibbard, Bennington	2 00
Best ewe, 1 year old, J. W. Hibbard, Bennington	6 00
2d do., J. W. Hibbard, Bennington	4 00
3d do., Amos Parmenter, Vernon	2 00
Best ewe lamb, J. W. Hibbard, Bennington	4 00
2d do., R. W. Mills, Saline	3 00
3d do., Amos Parmenter, Vernon	2 00

C. E. LOCKWOOD,
T. C. NELSON,
JOHN E. HORNER,
Judges.

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CLASS 26—SOUTHDOWNS.

Best ram, 2 years or over, J. F. Rundel, Birmingham	$15 00
2d do., Mrs. A. Newton, Pontiac	10 00
Best ram, 1 year old, J. F. Rundel, Birmingham	12 00
2d do., Mrs. A. Newton, Pontiac	8 00
Best ram lamb, J. F. Rundel, Birmingham	10 00
Best ewe, 2 years or over, Mrs. A. Newton, Pontiac	15 00
Best ewe, 1 year old, J. F. Rundel, Birmingham	12 00
2d do., Mrs. A. Newton, Pontiac	8 00
Best ewe lamb, J. F. Rundel, Birmingham	12 00

G. HOWARD,
L. S. DUNHAM,
Judges.

CLASS 27—SHROPSHIRES.

Best ram, 2 years or over, Jno. Milton, Marshall	$15 00
2d do., J. F. Rundel, Birmingham	10 00
3d do., E. D. Sabin, Hudson	6 00
Best ram, 1 year old, J. F. Rundel, Birmingham	12 00
2d do., Jno. Milton, Marshall	8 00
3d do., Jno. Moriarity, Hudson	5 00
Best ram lamb, Jno. Milton, Marshall	10 00
2d do., R R. Smith, Howell	6 00
3d do., Montgomery & Westfall, Hillsdale	4 00
Best ewe, 2 years or over, J. F. Rundel, Birmingham	15 00
2d do., Geo. Conley, Marshall	10 00
3d do, C. S. Bingham, Vernon	6 00
Best ewe, 1 year old, J. F. Rundel, Birmingham	12 00
2d do., J. F. Rundel, Birmingham	8 00
3d do., Jno. Milton, Marshall	5 00
Best ewe lamb, J. F. Rundel, Birmingham	10 00
2d do., C. S. Bingham, Vernon	6 00
3d do., R. R. Smith, Howell	4 00

G. HOWARD,
J. W. SALIARD,
L. S. DUNHAM,
Judges.

CLASS 28—HAMPSHIRES.

Best ram, 2 years or over, Mrs. A. Newton, Pontiac	$15 00
Best ram, 1 year old, John Moriarty, Hudson	12 00
2d do., Mrs. A. Newton, Pontiac	8 00
3d do., Mrs. A. Newton, Pontiac	5 00
Best ram lamb, John Moriarty, Hudson	10 00
2d do., Mrs. A. Newton, Pontiac	6 00
3d do., John Moriarty, Hudson	4 00
Best ewe, 2 years or over, Mrs. A. Newton, Pontiac	15 00
Best ewe, 1 year old, Mrs. A. Newton, Pontiac	12 00
Best ewe lamb, John Moriarty, Hudson	10 00
2d do., John Moriarty, Hudson	6 00
3d do., John Moriarty, Hudson	4 00

L. S. DUNHAM,
G. HOWARD,
Judges.

CLASS 29—OXFORDS.

Best ram, 2 years or over, Frank Willson, Jackson	$15 00
2d do., Mrs. A. Newton, Pontiac	10 00
3d do., W. A. Polley, Alamo	6 00
Best ram, 1 year old, Frank Willson, Jackson	12 00
2d do., C. A. Searing, Lyons	8 00
3d do., Frank Willson, Jackson	5 00

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Best ram lamb, Frank Willson, Jackson	$10 00
2d do., Mrs. A. Newton, Pontiac	6 00
3d do., C. A. Searing, Lyons	4 00
Best ewe, 2 years or over, Frank Willson, Jackson	15 00
2d do., Frank Wilson, Jackson	10 00
3d do., L. Ney Olmsted, Muir	6 00
Best ewe 1 year old, L. Ney Olmsted, Muir	12 00
2d do., Frank Willson, Jackson	8 00
3d do., W. A. Polley, Alamo	5 00
Best ewe lamb, Frank Willson, Jackson	10 00
2d do., Frank Willson, Jackson	6 00
3d do., L. Ney Olmsted, Muir	4 00

G. HOWARD,
L. S. DUNHAM,
Judges.

CLASS 30—COTSWOLDS.

Best ram, 2 years old or over, Montgomery & Westfall, Hillsdale	$15 00
2d do., Mrs. A. Newton, Pontiac	10 00
Best ram, 1 year old, Montgomery & Westfall, Hillsdale	12 00
Best ram lamb, Montgomery & Westfall, Hillsdale	10 00
2d do., Montgomery & Westfall, Hillsdale	6 00
3d do., Mrs. A. Newton, Pontiac	4 00
Best ewe, 2 years old or over, Frank Willson, Jackson	15 00
2d do., Mrs. A. Newton, Pontiac	10 00
3d do., Montgomery & Westfall, Hillsdale	6 00
Best ewe, 1 year old, Montgomery & Westfall, Hillsdale	12 00
2d do., Montgomery & Westfall, Hillsdale	8 00
3d do., Mrs. A. Newton, Pontiac	5 00
Best ewe lamb, Montgomery & Westfall, Hillsdale	10 00

G. HOWARD,
L. S. DUNHAM,
Judges.

CLASS 31—LEICESTERS.

Best ram, 2 years or over, Mrs. A. Newton, Pontiac	$15 00
2d do., Mrs. A. Newton, Pontiac	10 00
3d do., A. F. Wood, Mason	6 00
Second best ram, 1 year old, A. F. Wood, Mason	8 00
Best ram lamb, Mrs. A. Newton, Pontiac	10 00
2d do., A. F. Wood, Mason	6 00
3d do., Mrs. A. Newton, Pontiac	4 00
Best ewe, 2 years old or over, Mrs. A. Newton, Pontiac	15 00
2d do., A. F. Wood, Mason	10 00
3d do., Mrs. A. Newton, Pontiac	6 00
Best ewe, 1 year old, A. F. Wood, Mason	12 00
Best ewe lamb, Mrs. A. Newton, Pontiac	10 00
2d do., Mrs. A. Newton, Pontiac	6 00
3d do., A. F. Wood, Mason	4 00

L. S. DUNHAM,
G. HOWARD,
Judges.

CLASS 32—FAT SHEEP.

Best 2 middle wooled wethers, 2 years and under 3, Mrs. A. Newton, Pontiac.	$10 00
Best 2 middle wooled wethers, 1 year and under 2, J. F. Rundel, Birmingham	10 00
2d do., Mrs. A. Newton, Pontiac	8 00
Best 2 long wooled wethers, 2 years and under 3, Frank Willson, Jackson	10 00
Best 2 long wooled wethers, 1 year and under 2, Mrs. A. Newton, Pontiac	10 00
2d do., A. F. Wood, Mason	8 00

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Best 2 grade wethers, 2 years and under 3, Mrs. A. Newton, Pontiac	$10 00
2d do., Frank Willson, Jackson	8 00
Best 2 grade wethers, 1 year and under 2, Mrs. A. Newton, Pontiac	10 00
2d do., Frank Willson, Jackson	8 00

G. HOWARD,
L. S. DUNHAM,
Judges.

DIVISION D—SWINE.

CLASS 33—BERKSHIRES.

Best boar, 2 years or over, J. W. Hibbard, Bennington	$12 00
2d do., B. N. Cooley, Coldwater	8 00
3d do., G. D. White, So. Butler	4 00
Best boar, 1 year old, J. W. Hibbard, Bennington	10 00
3d do., G. D. White, So. Butler	3 00
Best boar, under 1 year, B. N. Cooley, Coldwater	8 00
2d do., J. W. Hibbard, Bennington	5 00
3d do., J. W. Hibbard, Bennington	3 00
Best sow, 2 years or over, B. N. Cooley, Coldwater	12 00
3d do., G. D. White, So. Butler	4 00
Best sow, 1 year old, J. W. Hibbard, Bennington	10 00
2d do., B. N. Cooley, Coldwater	6 00
3d do., B. N. Cooley, Coldwater	3 00
Best sow, under 1 year, J. W. Hibbard, Bennington	8 00
2d do., B. N. Cooley, Coldwater	5 00
3d do., J. W. Hibbard, Bennington	3 00
Best pen pigs, J. W. Hibbard, Bennington	8 00
2d do., J. W. Hibbard, Bennington	5 00
3d do., B. N. Cooley, Coldwater	3 00
Best boar, any age, B. N. Cooley, Coldwater	Diploma

DR. A. C. HAWLEY, *Judge.*

CLASS 33—ESSEX.

Best boar, 2 years or over, Frank Willson, Jackson	$12 00
2d do., M. H. Walworth, Hillsdale	8 00
3d do., A. & J. Chandler, Jerome	4 00
Best boar, 1 year old, E. T. Doney, Jackson	10 00
2d do., W. A Higgins, Jackson	6 00
3d do., A. & J. Chandler, Jerome	3 00
Best boar, under 1 year, Frank Willson, Jackson	8 00
2d do., E. T. Doney, Jackson	5 00
3d do., Frank Willson, Jackson	3 00
Best sow, 2 years or over, Frank Willson, Jackson	12 00
2d do., Frank Willson, Jackson	8 00
3d do., M. H. Walworth, Hillsdale	4 00
Best sow, 1 year old, Frank Willson, Jackson	10 00
2d do., Frank Willson, Jackson	6 00
3d do., Frank Willson, Jackson	3 00
Best sow, under 1 year, Frank Willson, Jackson	8 00
2d do., Frank Willson, Jackson	5 00
3d do., C. C. Dorr, Grass Lake	3 00
Best pen of pigs, W. A. Higgins, Jackson	8 00
2d do., Frank Willson, Jackson	5 00
3d do., A. & J. Chandler, Jerome	3 00
Best boar, any age, Frank Willson, Jackson	Diploma

DR. A. C. HAWLEY, *Judge.*

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CLASS 32—SUFFOLK, SMALL YORKSHIRE OR VICTORIA.

Best boar, 2 years or over, M. H. Walworth, Hillsdale	$12 00
2d do., W. M. Hilbert, Bath	8 00
Best boar, 1 year old, H. W. Riley, Greenville	10 00
2d do., M. H. Walworth, Hillsdale	6 00
3d do., M. H. Walworth, Hillsdale	3 00
Best boar, under 1 year, H. W. Riley, Greenville	8 00
2d do., Frank Willson, Jackson	5 00
3d do., Frank Willson, Jackson	3 00
Best sow, 2 years or over, M. H. Walworth, Hillsdale	12 00
2d do., W. M. Hilbert, Bath	8 00
Best sow, 1 year old, M. H. Walworth, Hillsdale	10 00
2d do., H. W. Riley, Greenville	6 00
3d do., H. W. Riley, Greenville	3 00
Best sow, under 1 year, M. H. Walworth, Hillsdale	8 00
2d do., Frank Willson, Jackson	5 00
3d do., Frank Willson, Jackson	3 00
Best pen of pigs, Frank Wilson, Jackson	8 00
2d do., Frank Willson, Jackson	5 00
3d do., H. W. Riley, Greenville	3 00
Best boar, any age, H. Riley, Greenville	Diploma

DR. A. C. HAWLEY, *Judge.*

CLASS 33—POLAND CHINA.

Best boar, 2 years old or over, Henry M. Morse, Union City	$12 00
2d do., L. W. & O. Barnes, Byron	8 00
3d do., W. S. Harris, Homer	4 00
Best boar, 1 year old, C. A. Limbeck, Dowagiac	10 00
2d do., W. S. Harris, Homer	6 00
3d do., L. W. & O. Barnes, Byron	3 00
Best boar, under 1 year, C. A. Limbeck, Dowagiac	8 00
2d do., A. H. Randall, Homer	5 00
3d do., W. S. Harris, Homer	3 00
Best sow, 2 years old or over, A. H. Randall, Homer	12 00
2d do., A. H. Randall, Homer	8 00
3d do., H. W. Riley, Greenville	4 00
Best sow, 1 year old, C. A. Limbeck, Dowagiac	10 00
2d do., Amos Parmenter, Vernon	6 00
3d do., L. W. & O. Barnes, Byron	3 00
Best sow, under 1 year old, C. A. Limbeck, Dowagiac	8 00
2d do., A. H. Randall, Homer	5 00
3d do., H. W. Riley, Greenville	3 00
Best pen of pigs, C. A. Limbeck, Dowagiac	8 00
2d do., W. S. Harris, Homer	5 00
3d do., G. F. Harrington, Paw Paw	3 00
Best boar, any age, C. A. Limbeck, Dowagiac	Diploma

DR. A. C. HAWLEY,
Judge.

CLASS 33—DUROC JERSEY.

Second best boar, 2 years old or over, Bissell & Badgley, Jackson	$8 00
Best boar, under 1 year, Quincy McBride, Burton	8 00
Best sow, 2 years old or over, Quincy McBride, Burton	12 00
3d do., Bissell & Badgley, Jackson	4 00
Best sow, 1 year old, Quincy McBride, Burton	10 00
Best sow, under 1 year old, Quincy McBride, Burton	8 00
Best pen of pigs, Quincy McBride, Burton	8 00
Best boar, any age, Quincy McBride, Burton	Diploma

DR. A. C. HAWLEY,
Judge.

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CLASS 33—CHESTER WHITE AND OTHER LARGE BREEDS N. E.

Best boar, 2 years old or over, Bissell & Badgley, Jackson	$12 00
2d do., C. F. Palmer, London	8 00
Best boar, 1 year old, C. A. Searing, Lyons	10 00
2d do., Raymond & Bowers, Manchester	6 00
3d do., C. A. Searing, Lyons	3 00
Best boar, under 1 year, C. A. Searing, Lyons	8 00
2d do., E. M. Searing, Lyons	5 00
3d do., C A. Searing, Lyons	3 00
Best sow, 2 years old or over, C. A. Searing, Lyons	12 00
Best sow, 1 year old, Raymond & Bowers, Manchester	10 00
Best sow, under 1 year old, C. A. Searing, Lyons	8 00
2d do., C. A. Searing, Lyons	5 00
3d do., E. M. Searing, Lyons	3 00
Best pen of pigs, C. A. Searing, Lyons	8 00
2d do., C. A. Searing, Lyons	5 00
3d do., Bissell & Badgley, Jackson	3 00
Best boar, any age, C. A. Searing, Lyons	Diploma

DR. A. C. HAWLEY,
Judge.

CLASS 33—FAT HOGS.

Best barrow, over 1 year, H. W. Riley, Greenville	$10 00
2d do., Quincy McBride, Burton	6 00
Best barrow, less 10 months, Frank Willson, Jackson	6 00
2d do., Frank Higgins, Jackson	4 00

DR. A. C. HAWLEY.
Judge.

DIVISION E—POULTRY.

CLASS 34.

Light Brahmas—	
Best pair fowls, Jas. F. Cunliffe, Jackson	$1 50
2d do., Myers Bros., Coldwater	1 00
Best pair chicks, Myers Bros., Coldwater	1 50
2d do., Jas. Ball, Marshall	1 00
Dark Brahmas—	
Best pair fowls, Jas. Ball, Marshall	1 50
Best pair chicks, E. E. Russell, Tecumseh	1 50
2d do., C. L. Hogue, Battle Creek	1 00
Buff Cochins—	
Best pair fowls, Jas. A. Tucker, Concord	1 50
2d do., Jas. A. Tucker, Concord	1 00
Best pair chicks, M. H. Walworth, Hillsdale	1 50
2d do., Z. A. Hartsuff, Unadilla	1 00
Partridge Cochins—	
Best pair fowls, Jas, Ball, Marshall	1 50
2d do., S. H. Slifer & Sons, Jackson	1 00
Best pair chicks, S. H. Slifer & Sons, Jackson	1 50
White Cochins—	
Best pair fowls, Jas. Ball, Marshall	1 50
2d do., Jas. Ball, Marshall	1 00
Best pair chicks, Jas. Ball, Marshall	1 50
2d do., Jas. Ball, Marshall	1 00
Black Cochins—	
Best pair fowls, Jas. Ball, Marshall	1 50
Best pair chicks, Jas. Ball, Marshall	1 50
2d do., Jas. Ball, Marshall	1 00
Langshans—	
Best pair fowls, Jas. Ball, Marshall	1 50
2d do., Floral City Yards, Monroe	1 00
Best pair chicks, Jas. Ball, Marshall	1 50
2d do., Floral City Yards, Monroe	1 00

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Plymouth Rocks—
Best pair fowls, C. L. Hogue, Battle Creek $1 50
2d do., C. L. Hogue, Battle Creek 1 00
Best pair chicks, C. L. Hogue, Battle Creek 1 50
2d do., C. L. Hogue, Battle Creek 1 00
Wyandottes—
Best pair fowls, C. L. Hogue, Battle Creek 1 50
2d do., Jas. Ball, Marshall 1 00
Best pair chicks, Jas. Ball, Marshall 1 50
2d do., L. B. Smith, Hanover 1 00
White Wyandottes—
Best pair fowls, C. L. Hogue, Battle Creek 1 50
Best pair chicks, C. L. Hogue, Battle Creek 1 50
2d do., C. L. Hogue, Battle Creek 1 00
Dominiques—
Best pair fowls, Jas. Ball, Marshall 1 50
2d do., M. H. Walworth, Hillsdale 1 00
Best pair chicks, Jas. Ball, Marshall 1 50
Black Breast Red Game Bantams—
Best pair fowls, C. L. Hogue, Battle Creek 1 50
2d do., C. L. Hogue, Battle Creek 1 00
Best pair chicks, C. L. Hogue, Battle Creek 1 50
2d do., C. L. Hogue, Battle Creek 1 00
Yellow Duck Wing Bantams—
Best pair fowls, Z. A. Hartsuff, Unadilla 1 50
Silver Duck-Wing Bantam—
Best pair fowls, Z. A. Hartsuff, Unadilla 1 50
2d do., Z. A. Hartsuff, Unadilla 1 00
White Pile Bantams—
Best pair fowls, Z. A. Hartsuff, Unadilla 1 50
Golden Seabright Bantams—
Best pair fowls, Z. A. Hartsuff, Unadilla 1 50
2d do., Z. A. Hartsuff, Unadilla 1 00
Best pair chicks, Z. A. Hartsuff, Unadilla 1 50
2d do., Z. A. Hartsuff, Unadilla 1 00
Japanese Bantams—
Best pair chicks, Floral City Yards, Monroe 1 50
Colored Dorkings—
Best pair fowls, M. H. Walworth, Hillsdale 1 50
Houdans—
Best pair fowls, A. G. Weston, Unadilla 1 50
2d do., Z. A. Hartsuff, Unadilla 1 00
Best pair chicks, A. G. Weston, Unadilla 1 50
2d do., A. G. Weston, Unadilla 1 00
Black Breasted Red Games—
Best pair fowls, A. G. Weston, Unadilla 1 50
Best pair chicks, A. G. Weston, Unadilla 1 50
Red Pile Games—
Best pair fowls, Eli Haley, Detroit 1 50
Best pair chicks, Eli Haley, Detroit 1 50
2d do., Eli Haley, Detroit 1 00
Black Sumatras—
Best pair fowls, Floral City Yards, Monroe 1 50
2d do., Floral City Yards, Monroe 1 00
Gold Spangled Hamburgs—
Best pair fowls, Myers Bros., Coldwater 1 50
2d do., M. H. Walworth, Hillsdale 1 00
Silver Spangled Hamburgs—
Best pair fowls, M. H. Walworth, Hillsdale 1 50
White Crested Black Polish—
Best pair fowls, Jas. Ball, Marshall 1 50
2d do., Z. A. Hartsuff, Unadilla 1 00
Best pair chicks, Jas. Ball, Marshall 1 50
2d do., A. E. Vosburgh, Battle Creek 1 00
White Polish—
Best pair fowls, A. G. Weston, Unadilla 1 50
Best pair chicks, A. E. Vosburgh, Battle Creek 1 50

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Golden Polish Bearded—	
Best pair fowls, Z. A. Hartsuff, Unadilla	$1 50
2d do., A. E. Vosburgh, Battle Creek	1 00
Best pair chicks, Z. A. Hartsuff, Unadilla	1 50
2d do., A. E. Vosburgh, Battle Creek	1 00
Silver Polish Bearded—	
Best pair fowls, Jas. Ball, Marshall	1 50
2d do., A. E. Vosburgh, Battle Creek	1 00
Best pair chicks, Jas. Ball, Marshall	1 50
2d do., A. E. Vosburgh, Battle Creek	1 00
Black Spanish—	
Best pair fowls, Z. A. Hartsuff, Unadilla	1 50
Single Comb White Leghorns—	
Best pair fowls, Z. A. Hartsuff, Unadilla	1 50
2d do., O. G. Kelly, Jackson	1 00
Best pair chicks, Z. A. Hartsuff, Unadilla	1 50
2d do., Dr. W. A. Gibson, Jackson	1 00
Single Comb Brown Leghorns—	
Best pair fowls, C. L. Hogue, Battle Creek	1 50
2d do., Myers Bros., Coldwater	1 00
Best pair chicks, C. L. Hogue, Battle Creek	1 50
2d do., C. L. Hogue, Battle Creek	1 00
Rose Comb White Leghorns—	
Best pair fowls, A. G. Weston, Unadilla	1 50
Best pair chicks, A. G. Weston, Unadilla	1 50
Rose Comb Brown Leghorns—	
Best pair chicks, E. O. Grosvenor, Monroe	1 50
2d do., E. O. Grosvenor, Monroe	1 00
Minorcas—	
Best pair fowls, Jno. J. White, Clinton	1 50
2d do., E. O. Grosvenor, Monroe	1 00
Best pair chicks, Jas. J. White, Clinton	1 50
2d do., E. O. Grosvenor, Monroe	1 00
Black Javas—	
Best pair fowls, Floral City Yards, Monroe	1 50
2d do., Myers Bros., Coldwater	1 00
Best pair chicks, Myers Bros., Coldwater	1 50
2d do., Floral City Yards, Monroe	1 00
White Javas—	
Best pair fowls, Floral City Yards, Monroe	1 50
Pekin Ducks—	
Best pair, A. G. Weston, Unadilla	1 50
2d do., Jas. Ball, Marshall	1 00
Rouen Ducks—	
Best pair, Jas. Ball, Marshall	1 50
2d do., Z. A. Hartsuff, Unadilla	1 00
White Muscovy Ducks—	
Best pair, Z. A. Hartsuff, Unadilla	1 50
Colored Muscovy Ducks—	
Best pair, Z. A. Hartsuff, Unadilla	1 50
Toulouse Geese—	
Best pair, Z. A. Hartsuff, Unadilla	1 50
2d do., Myers Bros., Coldwater	1 00
Embden Geese—	
Best pair, Z. A. Hartsuff, Unadilla	1 50
2d do., Z. A. Hartsuff, Unadilla	1 00
Brown China Geese—	
Best pair, Z. A. Hartsuff, Unadilla	1 50
2d do., Z. A. Hartsuff, Unadilla	1 00
Bronze Turkeys—	
Best pair, G. F. Harrington, Paw Paw	1 50
2d do., Z. A. Hartsuff, Unadilla	1 00
Peafowls—	
Best pair, Z. A. Hartsuff, Unadilla	1 50
2d do., Z. A. Hartsuff, Unadilla	1 00

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Pearl Guinea Fowls—	
Best pair, Z. A. Hartsuff, Unadilla	$1 50
2d do., Z. A. Hartsuff, Unadilla	1 00
White Guinea Fowls—	
Best pair, Z. A. Hartsuff, Unadilla	1 50
Best collection of pigeons, Melvin Gee, Jackson	1 50

DAVID JONES,
Judge.

DIVISION F.

CLASS 35—GRAINS AND SEEDS.

Best bushel red wheat, Bertha Blair, Napoleon	$3 00
2d do., A. L. Richardson, Jackson	2 00
Best bushel white wheat, F. E. Curtis, Napoleon	3 00
2d do., A. W. Jewett, Mason	2 00
Best bushel white oats, A. W. Jewett, Mason	2 00
2d do., Martin Tanner, Jackson	1 00
Best bushel black oats, A. W. Jewett, Mason	2 00
2d do., Ellison Seward, Jackson	1 00
Best bushel yellow oats, A. W. Jewett, Mason	2 00
Best 12 ears yellow dent corn, B. Hathaway, Little Prairie Ronde	1 50
2d do., C. Lazell, Napoleon	1 00
Best 12 ears white dent corn, A. O. Quick, Leoni	1 50
2d do., Martin Tanner, Jackson	1 00
Best 12 ears dent corn, A. W. Jewett, Mason	1 50
2d do., C. Lazell, Napoleon	1 00
Best 12 ears yellow flint corn, 12 rowed, C. Lazell, Napoleon	1 50
2d do., A. W. Jewett, Mason	1 00
Best 12 ears yellow flint corn, 8 rowed, C. Lazell, Napoleon	1 50
2d do., A. W. Jewett, Mason	1 00
Best 12 ears red flint corn, blazed, C. Lazell, Napoleon	1 50
2d do., A. W. Jewett, Mason	1 00
Best 12 ears white flint corn, 8 rowed, Martin Tanner, Jackson	1 50
2d do., C. Lazell, Napoleon	1 00
Best 12 ears white flint corn, blazed, C. Lazell, Napoleon	1 50
Best 12 ears sweet corn, early, B. Hathaway, Little Prairie Ronde	1 50
2d do., Wm. Miller, Mason	1 00
Best 12 ears sweet corn, late, A. W. Jewett, Mason	1 50
2d do., W. S. Mason, Hanover	1 00
Best 12 ears pop corn, C. Lazell, Napoleon	2 50
2d do., Martin Tanner, Jackson	1 00
Best bushel rye, Martin Tanner, Jackson	2 00
2d do., Mrs. Amy Quithel, Rives Junction	1 00
Best bushel 4 rowed barley, A. W. Jewett, Mason	2 00
2d do., W. H. Hanna, Leoni	1 00
Best bushel small clover seed, Chas. R. Parsons, Saline	3 00
2d do., Martin Tanner, Jackson	2 00
Best bushel timothy seed, Martin Tanner, Jackson	2 00
2d do., A. W. Jewett, Mason	1 00
Best bushel buckwheat, A. W. Jewett, Mason	2 00
2d do., J. H. Cowing, Henrietta	1 00
Best bushel flax seed, A. W. Jewett, Mason	2 00
Best bushel red top grass seed, A. W. Jewett, Mason	2 00
Best bushel blue grass seed, A. W. Jewett, Mason	2 00
Best bushel Hungarian grass seed, A. W. Jewett, Mason	2 00
Best bushel millet, A. W. Jewett, Mason	2 00
Best bushel peas, J. H. Cowing, Henrietta	2 00
2d do., Jos. Morris, Marlette	1 00
Best bushel white beans, A. W. Jewett, Mason	2 00
2d do., Martin Tanner, Jackson	1 00
Best display seeds, etc., A. W. Jewett, Mason	10 00
Best display grain in head, A. W. Jewett, Mason	10 00
2d do., Mrs. C. R. Honeywell, Cressy's Corners	5 00

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Best display corn, in ear, C. Lazell, Napoleon	$10 00
2d do., A. W. Jewett, Mason	5 00

CLASS 36—ROOTS AND VEGETABLES.

Early Potatoes—	
Best peck Sunrise, C. J. Miller, Mason	$1 50
2d do., Jos. Morris, Marlette	1 00
Best peck Vermont, A. W. Jewett, Mason	1 50
Best peck Ohio, Mrs. Amy Quithel, Rives Junction	1 50
2d do., A. W. Jewett, Mason	1 00
Best peck Beauty of Hebron, John McComb, Jackson	1 50
2d do., A. W. Jewett, Mason	1 00
Best peck Ontario, A. W. Jewett, Mason	1 50
2d do., C. J. Miller, Mason	1 00
Late Potatoes—	
Best peck Late Rose, A. W. Jewett, Mason	1 50
2d do., Mrs. Mary Poff, Marshall	1 00
Best peck White Elephant, Mrs. Mary Poff, Marshall	1 50
2d do., A. W. Jewett, Mason	1 00
Best peck Granger, A. W. Jewett, Mason	1 00
Best peck Burbank, A. W. Jewett, Mason	1 50
Best peck Mammoth Pearl, A. W. Jewett, Mason	1 50
2d do., C. J. Miller, Mason	1 00
Best peck White Star, John McComb, Jackson	1 50
2d do., A. W. Jewett, Mason	1 00
Best peck Belle, A. W. Jewett, Mason	1 50
2d do., C. J. Miller, Mason	1 00
Best peck Beauty of Hebron, A. W. Jewett, Mason	1 50
2d do., C. J. Miller, Mason	1 00
Best peck Snow Flake, A. W. Jewett, Mason	1 50
2d do., C. Lazell, Napoleon	1 00
Best peck sweet potatoes, B. Hathaway, Little Prairie Ronde	1 50
Best 6 blood beets, Mrs. Mary Poff, Marshall	1 50
2d do., Jos. Morris, Marlette	1 00
Best 6 turnip beets, Jas. Morris, Marlette	1 50
2d do., A. W. Jewett, Mason	1 00
Best 6 sugar beets, C. J. Miller, Mason	1 50
2d do., Wm. Miller, Mason	1 00
Best 6 white or yellow beets, Wm. Miller, Mason	1 50
2d do., E. B. Cochran, Parma	1 00
Best 6 beets, for table use, A. W. Jewett, Mason	1 50
2d do., C. J. Miller, Mason	1 00
Best 6 mangel wurzels, A. W. Jewett, Mason	1 50
2d do., Jos. Morris, Marlette	1 00
Best 6 orange carrots, Mrs. Mary Poff, Marshall	1 50
2d do., Mrs. M. E. Bartlett, Tompkins	1 00
Best 6 white carrots, Frank Willson, Jackson	1 50
2d do., Mrs. Mary Poff, Marshall	1 00
Best 6 carrots, Jos. Morris, Marlette	1 50
2d do., C. Lazell, Napoleon	1 00
Best 6 flat turnips Mrs. Amy Quithel, Rives Junction	1 50
2d do., A. W. Jewett, Mason	1 00
Best 6 Swede turnips, Jos. Morris, Marlette	1 50
2d do., Wm. Miller, Mason	1 00
Best 6 turnips, C. J. Miller, Mason	1 50
2d do., Wm. Miller, Mason	1 00
Best 6 parsnips, Mrs. Mary Poff, Marshall	1 50
2d do., A. D. Quick, Jackson	1 00
Best 6 salsify, A. W. Jewett, Mason	1 50
2d do., C. J. Miller, Mason	1 00
Best 6 winter radishes, Jos. Morris, Marlette	1 50
2d do., A. W. Jewett, Mason	1 00
Best 6 summer radishes, C. Lazell, Napoleon	1 50
2d do., C. J. Miller, Mason	1 00
Best 4 drumhead cabbage, C. J. Miller, Mason	1 50
2d do., Wm. Miller, Mason	1 00

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Best 4 conehead cabbage, C J. Miller, Mason	$1 50
2d do., A. W. Jewett, Mason	1 00
Best 4 red cabbage, A. W. Jewett, Mason	1 50
Best 4 heads cauliflower, A. W. Jewett, Mason	1 50
2d do., H. Purdy, Jackson	1 00
Best 6 heads lettuce, H. Purdy, Jackson	1 50
2d do., A. W. Jewett, Mason	1 00
Best 6 bunches kale, A. W. Jewett, Mason	1 50
Best 12 stems celery, bleached, S. Heyser, Jackson	1 50
2d do., H. Purdy, Jackson	1 00
Best 12 stems rhubarb, C. Lazell, Napoleon	1 50
2d do., C. J. Miller, Mason	1 00
Best ½ doz. vegetable eggs, A. W. Jewett, Mason	1 50
2d do., Mrs. J. C. Sharp, Jackson	1 00
Best doz. peppers, A. W. Jewett, Mason	1 50
2d do., W. S. Mason, Hanover	1 00
Best 3 varieties tomatoes, 1 doz. each, A. W. Jewett, Mason	1 50
Best peck tomatoes, C. J. Miller, Mason	1 50
2d do., Mrs. Mary Poff, Marshall	1 00
Best peck white onions, A. W. Jewett, Mason	1 50
2d do., C. J. Miller, Mason	1 00
Best peck red onions, F. Hart Smith, Somerset	1 50
2d do., C. Lazell, Napoleon	1 00
Best peck yellow onions, A. W. Jewett, Mason	1 50
2d do., Geo. R. Elms, Jackson	1 00
Best 5 summer squash, C. Lazell, Napoleon	1 50
2d do., A. W. Jewett, Mason	1 00
Best 5 marrow squash, C. J. Miller, Mason	1 50
2d do., J. C. Sharp, Jackson	1 00
Best 5 Hubbard squash, Wm. Miller, Mason	1 50
Best single squash, A. D. Quick, Jackson	1 50
2d do., C Lazell, Napoleon	1 00
Best 2 sweet pumpkins, C. Lazell, Napoleon	1 50
2d do., A. W. Jewett, Mason	1 00
Best 2 field pumpkins, Martin Tanner, Jackson	1 50
2d do., C. Lazell, Napoleon	1 00
Best 3 water melons, A. D. Quick, Jackson	1 50
2d do., A. O. Quick, Leoni	1 00
Best 3 musk melons, A. O. Quick, Leoni	1 50
2d do., A. D. Quick, Jackson	1 00
Best 3 nutmeg melons, C. Lazell, Napoleon	1 50
2d do., Mrs. M. E. Bartlett, Tompkins	1 00
Best 3 citrons, P. S. Ray, Norville	1 50
2d do., C. Lazell, Napoleon	1 00
Best 5 cucumbers, C. Lazell, Napoleon	1 50
2d do., A. W. Jewett, Mason	1 00
Best half peck garden pease, A. W. Jewett, Mason	1 50
Best half peck Lima beans, A. W. Jewett, Mason	1 50
2d do., W. S. Mason, Hanover	1 00
Best half peck bush beans, A. W. Jewett, Mason	1 50
Best half peck wax beans, A. W. Jewett, Mason	1 50
2d do., H. Purdy, Jackson	1 00
Best 6 heads sunflower, C. Lazell, Napoleon	1 50
2d do., E. B. Cochran, Parma	1 00
Best 6 stems Swiss chard, C. Lazell, Napoleon	1 50
2d do., Mrs. M. E. Bartlett, Tompkins	1 00
Best 6 stems parsley, A. W. Jewett, Mason	1 50
2d do., H. Purdy, Jackson	1 00
Best 6 stems spinach, C. Lazell, Napoleon	1 50
Best 6 stems kohl rabi, W. S. Mason, Hanover	1 50
2d do., E. B. Cochran, Parma	1 00

MANLY MILES,
Judge.

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CLASS 37—DISPLAY ROOTS AND VEGETABLES.

Best display by professional, Z. J. & H. B. Davis, Jackson	$40 00
Best display of potatoes, A. W. Jewett, Mason	25 00

MANLY MILES,
Judge.

CLASS 38—FLOUR, MEAL AND FEED.

Best barrel white wheat flour, J. W. Flemning, Jackson	$3 00
Best barrel red wheat flour, McClure & Egbert, Charlotte	3 00
Best 50 pounds bolted meal, J. W. Flemning, Jackson	2 00
Best 50 pounds corn meal, J. W. Flemning, Jackson	2 00
Best 50 pounds ground flour, J. W. Flemning, Jackson	2 00
Best 50 pounds graham flour, J. W. Flemning, Jackson	2 00
Best display flour and meal, J. W. Flemning, Jackson	5 00

MANLY MILES,
Judge.

DIVISION G.

CLASS 39—BUTTER, CHEESE AND DAIRY ARTICLES.

Best 15 pounds domestic butter, made any time, Quincy McBride, Burton	$10 00
2d do., Frank Aldrich, Liberty	8 00
3d do., Ray S. Parma, Norville	5 00
Second best 25 pounds creamery butter, made any time, Ogden Cole, Addison	8 00
Best 5 pounds print butter, Frank Aldrich, Liberty	4 00
2d do., Mrs. D. H. Ranney, Jackson	3 00
Second best display cheese, Jno. W. Barst, Vriesland	10 00

HENRY CHAMBERLAIN,
SAM'L JOHNSON,
Judges.

CLASS 40—SUGAR, BREAD AND PICKLES.

Best 10 pounds maple sugar, Ogden Cole, Addison	$5 00
Best gallon maple syrup, D. L. Garver, Hart	3 00
Best 5 gallons sorghum syrup, J. H. Cowing, Henrietta	10 00
2d do., Mrs. Amy Quithel, Rives Junction	5 00
Best machine made bread, Jno. A. Shelly, Jackson	3 00
Best 2 loaves baker's bread, J. Peterman & Co., Jackson	3 00
Best 2 loaves salt rising bread, Mrs. J. L. Thorn, Harton	3 00
2d do., Jno. A. Shelly, Jackson	2 00
Best soda rising bread, Mrs. M. E. Bartlett, Tompkins	3 00
2d do., Mrs. S. J. Madden, Jackson	1 00
Best 2 loaves yeast bread, Mrs. S E. Wells, Jackson	3 00
2d do., Mrs. M. E. Bartlett, Tompkins	1 00
Best corn bread, Mrs. Jas. DePuy, Jackson	3 00
2d do., Bertha L. Blair, Napoleon	2 00
Best 2 loaves brown bread, Mrs. M. E. Bartlett, Tompkins	3 00
2d do., Mrs. Amy Quithel, Rives Junction	2 00
Best 2 loaves rye bread, Mrs. M. E. Bartlett, Tompkins	3 00
2d do., Mrs. Amy Quithel, Rives Junction	2 00
Best display pickled vegetables, W. S. Mason, Hanover	5 00
2d do., Mrs. M. E. Bartlett, Tompkins	3 00

MRS. H. H. BINGHAM,
MRS. D. MERRIMAN,
Judges.

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DIVISION H.

CLASS 42—BEES, HONEY AND APIARIAN IMPLEMENTS.

Best colony black bees, W. Z. Hutchinson, Flint	$10 00
2d do., W. D. Soper, Jackson	5 00
Best colony Italian bees, H. D. Cutting, Clinton	10 00
2d do., W. Z. Hutchinson, Flint	5 00
Best colony Syrian bees, W. Z. Hutchinson, Flint	10 00
2d do., W. D. Soper, Jackson	5 00
Best colony Carniolan bees, H. D. Cutting, Clinton	10 00
2d do., W. Z. Hutchinson, Flint	5 00
Best display full colonies different races of bees, W. Z. Hutchinson, Flint	10 00
2d do., W. D. Soper, Jackson	5 00
Best species comb honey, H. D. Cutting, Clinton	10 00
2d do., Miss A. R. Cutting, Clinton	5 00
Best display comb honey, H. D. Cutting, Clinton	20 00
2d do., W. D. Soper, Jackson	10 00
Best display comb honey, by lady, Miss A. R. Cutting, Clinton	10 00
Best specimen beeswax, H. D. Cutting, Clinton	5 00
2d do., Miss A. R. Cutting, Clinton	3 00
Best comb foundation, made on the grounds, H. D. Cutting, Clinton	5 00
2d do., Miss A. R. Cutting, Clinton	3 00
Best specimen comb foundation, W. D. Soper, Jackson	4 00
2d do., H. D. Cutting, Clinton	2 00
Best honey producing plants, H. D. Cutting, Clinton	10 00
2d do., Miss A. R. Cutting, Clinton	5 00
Best exhibit in Division H., H. D. Cutting, Clinton	10 00

M. H. HUNT, *Judge.*

DIVISION L—MANUFACTURED GOODS.

CLASS 52—MATERIALS.

2d best display prepared flax, Mrs. Lucy McClary, Galesburg	3 00

EUGENE FIFIELD,
A. J. BROW,
Judges.

CLASS 55—ARTICLES OF LEATHER AND INDIA RUBBER.

2d best horse collar made in State, H. L. Merriman, Jackson	$1 00
Best display of 10 trunks, H. L. Merriman, Jackson	10 00
Best double carriage harness made in State, H. L. Merriman, Jackson	3 00
Best single buggy harness made in State, H. L. Merriman, Jackson	3 00
2d best double harness for farm use made in State, H. L. Merriman, Jackson	2 00
Best cart harness made in the State, H. L. Merriman, Jackson	2 00
2d best gent's riding saddle made in State, H. L. Merriman, Jackson	2 00
2d best riding bridle made in the State, H. L. Merriman, Jackson	1 00
Best harness for holding vicious horse, J. F. Track, Winfield	1 00

EUGENE FIFIELD,
A. J. BROW,
Judges.

CLASS 56—ARTICLES OF FURNITURE.

Best display furniture, H. C. Ransom, Jackson	$25 00
Best set parlor furniture, H. C. Ransom, Jackson	20 00
Best set chamber furniture, H. C. Ransom, Jackson	10 00
Best set dining chairs, H. C. Ransom, Jackson	3 00
Best book case, H. C. Ransom, Jackson	3 00
Best child's crib, H. C. Ransom, Jackson	2 00
Best child's carriage, H. C. Ransom, Jackson	2 00

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Best desk, H. C. Ransom, Jackson	$3 00
Best easy chair, Mrs. Jacob Beck, Sebewaing	3 00
2d do., H. C. Ransom, Jackson	2 00
Best extension table, H. C. Ransom, Jackson	3 00
2d best hat rack, Mrs. Jacob Beck, Sebewaing	1 00
Best lounge, H. C. Ransom, Jackson	3 00
Best library table, H. C. Ransom, Jackson	3 00
Best mantel mirror, H. C. Ransom, Jackson	5 00
2d best mattress, H. C. Ransom, Jackson	1 00
Best office desk, H. C. Ransom, Jackson	3 00
Best office chair, H. C. Ransom, Jackson	2 00
Best parlor writing desk, H. C. Ransom, Jackson	3 00
Best pier mirror and base, H. C. Ransom, Jackson	5 00
Best sofa, H. C. Ransom, Jackson	3 00
2d best smoking and lounging chair, H. C. Ransom, Jackson	2 00
Best sideboard, H. C. Ransom, Jackson	3 00
Best secretary, H. C. Ransom, Jackson	3 00
Best spring mattress, H. C. Ransom, Jackson	2 00
2d best upholstered reception chair, H. C. Ransom, Jackson	2 00

EUGENE FIFIELD,
A. J. BROW,
Judges.

CLASS 57—STOVES, IRON WORK, ETC.

Best display stoves, Pierce & Belden, Jackson	$5 00
Best display of plumbing and brass goods, R. A. Gibson, Jackson	5 00
Best folding bath tub, Marshall Furnace Co., Marshall	3 00

EUGENE FIFIELD,
A. J. BROW,
Judges.

DIVISION M—MUSICAL GOODS, ETC.

CLASS 60—CLOCKS, JEWELRY, ETC.

2d best clock, C. E. Aldrich, Jackson	$2 00

EUGENE FIFIELD,
A. J. BROW,
Judges.

DIVISION N—PAINTING, SCULPTURE, ETC.

CLASS 61—BY PROFESSIONALS OR AMATEURS.

Best col. oil paintings, not less 125 in No., Brow & Baxter, Detroit	$200 00
Best col. water colors, not less 25 in No., Brow & Baxter, Detroit	25 00
Best historical painting in oil, Brow & Baxter, Detroit	20 00
2d do., Brow & Baxter, Detroit	10 00
Best landscape painting in oil, of scenery in Mich., Brow & Baxter, Detroit	10 00
2d do., Brow & Baxter, Detroit	5 00
Best landscape painting in oil, Brow & Baxter, Detroit	10 00
2d do., Brow & Baxter, Detroit	5 00
Best landscape painting in water colors, scenery in Mich., Brow & Baxter, Detroit	8 00
2d do., Brow & Baxter, Detroit	5 00
Best marine in oil, Brow & Baxter, Detroit	10 00
2d do., Brow & Baxter, Detroit	5 00
Best portrait in oil, Brow & Baxter, Detroit	10 00
2d do., Brow & Baxter, Detroit	5 00
Best pastel of landscape, Brow & Baxter, Detroit	5 00
2d do., Brow & Baxter, Detroit	3 00
Best special subject in oil, Brow & Baxter, Detroit	5 00
2d do., Carl O. Johnson, Jackson	3 00

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Best special subject in water colors, Brow & Baxter, Detroit	$5 00
2d do., Brow & Baxter, Detroit	3 00
Best winter piece in oil, Brow & Baxter, Detroit	10 00
2d do., Brow & Baxter, Detroit	5 00
Best display of gilt frames, Brow & Baxter, Detroit	5 00
2d do., W. W. Bennett, Jackson	3 00
Best display frames in bronze or wood, W. W. Bennett, Jackson	5 00
2d do., Brow & Baxter, Detroit	3 00
Best display marble statuary, by dealer, W. W. Bennett, Jackson	20 00
Best display artist's materials, by dealer, W. W. Bennett, Jackson	20 00
Best animal photo, Miss Clara Coston, Jackson	3 00
Best collection photos, not less 20 in No., Thurtle & Fleming, Jackson	10 00
2d do., Miss Clara Coston, Jackson	5 00
Best 3 cabinet photos, Miss Clara Coston, Jackson	2 00
Best portrait photo, colored, cabinet size, Miss Clara Coston, Jackson	2 00
Best animal piece, in oil, Carl O. Johnson, Jackson	10 00
2d do., Carl O. Johnson, Jackson	5 00
Best composition landscape, in oil, H. S. Bullock, Detroit	5 00
2d do., Robert Hopkin, Detroit	3 00
Best col. oil paintings, not less 5 in No., Robert Hopkin, Detroit	10 00
2d do., W. B. Conely, Detroit	5 00
Best col. water color paintings, not less 5 in No., John Owen, Detroit	5 00
2d do., Miss Clara Coston, Jackson	3 00
Best fruit piece in oil, W. B. Conely, Detroit	5 00
2d do , W. B. Conely, Detroit	3 00
Best fancy painting in oil, W. B. Conely, Detroit	5 00
2d do., Grace W. Ford, Jackson	3 00
Best fancy painting in water colors, C. F. Greiner, Allegan	5 00
2d do., Miss Clara Coston, Jackson	3 00
2d best historical painting in oil, J. A. Russell, Centreville	5 00
Best landscape from nature in oil, W. B. Conely, Detroit	10 00
2d do., Robert Hopkin, Detroit	5 00
Best landscape painting in water colors, Robert Hopkin, Detroit	10 00
2d do., H. S. Bullock, Detroit	5 00
Best marine in oil, Robert Hopkin, Detroit	10 00
2d do., Robert Hopkin, Detroit	5 00
Best portrait, from life, large size, in oil, Carl O. Johnson, Jackson	10 00
2d do., Miss H. M. Edgar, Jackson	5 00
Best pastel portrait, Miss Clara Coston, Jackson	5 00
Best pastel painting, Miss Clara Coston, Jackson	5 00
Best winter piece in oil, Miss Clara Coston, Jackson	5 00
2d do., Grace Ford, Jackson	3 00
Best crayon portrait, C F. Greiner, Allegan	5 00
2d do., Miss Clara Coston, Jackson	3 00
Non-Enumerated.	
Best solar prints, Messrs R. Bailey & Son, Jackson	3 00
Best solar prints, E. D. Bailey, Jackson	3 00
Best display etching engravings, W. W. Bennett, Jackson	10 00
Best portrait in water colors, Miss H. M. Edgar, Jackson	3 00
Best screen, Miss Kate Palen, Jackson	3 00
Best portrait in water colors, F. W. Spencer, Jackson	5 00
Best specimen marble statuary in pastel, F. W. Spencer, Jackson	3 00

M. W. LAWTON,
F. D. WELLING,
L. D. WATKINS,
Judges.

CLASS 62—PAINTING AND DRAWING BY AMATEURS.

Best bird piece in oil. Miss Nelly Edgar, Jackson	$3 00
2d do., Minnie B. Blair, Napoleon	2 00
Best composition landscape in oil, Mrs. W. S. Wilcox, Adrian	3 00
2d do., Mrs. L. A. Cooley, Jackson	2 00
Best collection oil paintings, not less 5, Mrs. W. S. Wilcox, Adrian	3 00
2d do., Grace W. Ford, Jackson	2 00
Best collection paintings on slate, not less 5, Mrs. L. A. Cooley, Jackson	3 00

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Best fruit piece in oil, Mrs. W. S. Wilcox, Adrian	$3 00
2d do., Miss H. M. Edgar, Jackson	2 00
Best flower piece in oil, Mrs. W. S. Wilcox, Adrian	3 00
2d do., Mrs. W. S. Wilcox, Adrian	2 00
Best fancy piece in oil, Grace W. Ford, Jackson	3 00
2d do., Miss Nellie Edgar, Jackson	2 00
Best landscape in oil, scenery in Michigan, Mrs. W. S. Wilcox, Adrian	5 00
2d do., Orlo Vickery, Jackson	3 00
Best landscape in oil, from nature, Mrs. W. S. Wilcox, Adrian	5 00
Best marine in oil, Mrs. W. S. Wilcox, Adrian	3 00
2d do., Mrs. Delia Bedell, Jackson	2 00
Best painting on porcelain, Mrs. Delia Bedell, Jackson	3 00
2d do., Grace W. Ford, Jackson	2 00
Best painting on ebonized panel, Minnie B. Blair, Napoleon	3 00
Best specimen painting on plaque, Mrs. Mary Poff, Marshall	3 00
2d do., Miss Delia Bedell, Jackson	2 00
Best specimen painting on slate, Mrs. L. A. Cooley, Jackson	3 00
Best crayon of face, Grace W. Ford, Jackson	3 00
Best crayon of animal, Dayton A. Austin, Jackson	3 00
2d do., Grace W. Ford, Jackson	2 00
Best crayon of landscape, Grace W. Ford, Jackson	2 00
Best pencil of animal, Miss Nellie Cotter, Jackson	2 00
Best pencil of landscape, Miss Nellie Cotter, Jackson	2 00
Best pencil drawing by person under 16 years, Miss Nellie Cotter, Jackson	2 00
Non-enumerated.	
Best marine in crayon, Grace W. Ford, Jackson	3 00
Best miniature house, Elizabeth Hunnewell, Cressy's Corners	3 00

M. W. LAWTON,
F. D. WELLING,
L. D. WATKINS,
Judges.

DIVISION O—NEEDLE AND FANCY WORK.

CLASS 63—ARTICLES OF LADIES' DRESS.

Best child's suit, Mrs. W. P. Heaton, Jackson	$2 00
Best corset, Jackson Corset Co., Jackson	2 00
Best display millinery, J. C. Richardson & Co., Jackson	5 00
Best infant's suit, Mrs. J. E. Tyrrell, Jackson	1 00
2d do., Mrs. L. A. Cooley, Jackson	50
Best suit under garments, E. J. Odell, Leóni	2 00
2d do., Mrs. J. C. Sharp, Jackson	1 00

FANNIE WETMORE,
MARY B. ROBINSON,
Judges.

CLASS 64—PLAIN NEEDLE AND MACHINE WORK.

2d best braiding, by hand, Mrs. E. S. Brownson, Jackson	$0 50
Best sample darning, Elizabeth Kessler, Jackson	1 00
2d do., Mrs. O. K. Barden, Jackson	50
Best specimen hemstitching, Mrs. M. E. Bartlett, Tompkins	2 00
Best patched garment, sample, Elizabeth Kessler, Jackson	1 00
2d do., Mrs. M. A. Chisholm, Marshall	50
Best pair plain handkerchiefs, by hand, Mrs. H. C. Forbes, Kalamazoo	1 00
Best pair plain pillow cases, Mrs. Lucy McClary, Galesburg	1 00
2d do., Mrs. M. E. Bartlett, Tompkins	50
Best pair plain sheets, by hand, Mrs. M. E. Bartlett, Tompkins	1 00
2d do., Mrs. H. C. Forbes, Kalamazoo	50
Best quilt, plain white muslin, by hand, Mrs. Lucy McClary, Galesburg	2 00
2d do., plain white muslin, by hand, Mrs. E. S. Brownson, Jackson	1 00
Best quilt, calico patch work, by hand, Mrs. E. B. Chapman, Jackson	2 00
2d do., Mrs. E. Stephenson, Jackson	1 00

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Best quilt, silk patchwork, by hand, Miss Mary Childs, Jackson	$5 00
2d do., Mrs. C. F. Knapp, Jackson	3 00
Best quilt, worsted patchwork, by hand, E. J. Odell, Leoni	2 00
2d do., Mrs. L. A. Cooley, Jackson	1 00
2d best quilt, made and quilted by hand, Mrs. S. J. Madden, Jackson	1 00

EMMA J. RICE,
MRS. A. G. AMES,
Judges.

CLASS 65—EMBROIDERY AND ORNAMENTAL NEEDLEWORK.

Best applique embroidery, Mrs. Frank Stebbins, Adrian	$2 00
Best arasene do., Mrs. S. H. Webster, Jackson	2 00
2d do., Mrs. E. K. Chapman, Jackson	1 00
Best chenille embroidery, Miss Bertha Blair, Napoleon	2 00
2d do., Mrs. E. S. Brownson, Jackson	1 00
Best crewel embroidery, Miss Bertha Blair, Napoleon	2 00
Best Kensington do., Mrs. Frank Stebbins, Adrian	2 00
2d do., Miss Mary Childs, Jackson	1 00
Best collection embroidery, Mrs. Frank Stebbins, Adrian	6 00
Best embroidered banner, Mrs. Frank Stebbins, Adrian	2 00
2d do., Miss Bertha Blair, Napoleon	1 00
2d embroidered ottoman cover, in worsted, Mrs. E. S. Brownson, Jackson	1 00
Best embroidered chair cover, in silk, Mrs. Frank Stebbins, Adrian	2 00
Best embroidered ottoman cover, in silk, Mrs. Frank Stebbins, Adrian	2 00
2d do., Miss Nellie Cotter, Jackson	1 00
Best embroidered foot rest, Bertha S. Blair. Napoleon	1 00
Best embroidered handkerchief, in cotton or linen, Mrs. C. F. Knapp, Jackson	1 00
Best embroidered letters, in silk, Carrie H. Choate, Jackson	1 00
2d do., Nellie Cotter, Jackson	50
Best embroidered lady's dress or cloak, in silk, Mrs. E. S. Brownson, Jackson	3 00
Best embroidered night dress, in cotton or linen, Mrs. O. Barden, Jackson	2 00
2d do., A. D. Quick, Jackson	1 00
Best embroidered pillow shams in cotton or linen, Mrs. E. S. Brownson, Jackson	2 00
2d do., Mrs. C. F. Knapp, Jackson	1 00
Best embroidered piano or table cover, Mrs. Frank Stebbins, Adrian	4 00
2d do., Bertha S. Blair, Jackson	2 00
Best embroidered sofa pillow, in silk, Mrs. Frank Stebbins, Adrian	3 00
2d do., Nellie Cotter, Jackson	1 00
Best embroidered sofa pillow, in worsted, Mrs. J. C. Sharp, Jackson	2 00
Best embroidered tidy, in silk, Miss Mary Child, Jackson	2 00
2d do., Mrs. Jason Rich, Hastings	1 00
Best embroidered toilet set, Mrs. Frank Stebbins, Adrian	2 00
2d do., Mrs. L. A. Cooley, Jackson	1 00
Best embroidered table scarf, Mrs. Frank Stebbins, Adrian	2 00
2d do., Miss Mary Child, Jackson	1 00
2d best collection netted lace, Miss Ella Butler, Union City	2 00
Best specimen drawn work, J. A. Porter, Brooklyn	2 00
2d do., Miss Ella Butler, Union City	1 00
Best darned net work, bed spread and pillow sham, Mrs. W. P. Heaton, Jackson	3 00
Best specimen etching in cotton, linen or silk, Mrs. Frank Stebbins, Adrian	2 00
2d do., Mrs. J. C. Sharp, Jackson	1 00
Best fancy pin cushion, Mrs. Frank Stebbins, Adrian	1 00
2d do., Mrs. E. S. Brownson, Jackson	50
Best fancy bag, Mrs. Frank Stebbins, Adrian	1 00
2d do., Miss Mary Child, Jackson	50
Best fancy apron, Mrs. Frank Stebbins, Adrian	1 00
2d do., Miss Ella Butler, Union City	50
Best home made rug, crochet or knit, Mrs. W. R. Cady, Grand Rapids	2 00
2d do., Mrs. E. W. Raplee, Jackson	1 00
Best home-made rug, drawn, W. K. Sexton, Howell	2 00
2d do., M. E. Bartlett, Tompkins	1 00

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Best pair lamp mats, in worsted, Mrs. O. K. Barden, Jackson	$1 00
2d do., Bertha S. Blair, Napoleon	50
Best specimen macrame work, Mrs. J. E. Tyrrell, Jackson	2 00
2d do., Mrs. S. H. Webster, Jackson	1 00
Best mantel lambrequin, Mary E. Child, Jackson	2 00
2d do., Mrs. C. F. Knapp, Jackson	1 00
Best specimen rick rack, M. E. Bartlett, Tompkins	1 00
2d do., Mrs. M. A. Chisholm, Marshall	50
Best toilet set, in lace or muslin, Mary E. Child, Jackson	1 00
Best tatting, Mrs. B. T. Murray, Jackson	1 00
2d do., Bertha S. Blair, Napoleon	50
Non enumerated.	
Best embroidered napkins, in silk, Grace W. Ford, Jackson	1 00

FANNY WETMORE,
MARY B. ROBINSON,
Judges.

CLASS 66—CROCHET, KNIT AND FANCY WORK.

Best knit bedspread, Mrs. Uri Isbell, Stockbridge	$3 00
2d do., Mrs. J. L. Thorn, Horton	2 00
Best cotton tidy, Mrs. C. F. Knapp, Jackson	2 00
2d do., M. E. Bartlett, Tompkins	1 00
2d child's crochet cap, Mrs. B. B. Van Dyne, Jackson	50
Best child's shirt, crochet or knit, Mrs. Uri Isbell, Stockbridge	2 00
2d do., Carrie Choate, Jackson	1 00
Best collection work in this class, by 1 person, Mrs. B. B. Van Dyne, Jackson	5 00
2d do., Mrs. O. Barden, Jackson	3 00
Best fancy knit mittens, Carrie H. Choate, Jackson	2 00
2 d do., Carrie H. Choate, Jackson	1 00
2d crochet purse, Carrie H. Choate, Jackson	50
Best crochet hood, Carrie H. Choate, Jackson	2 00
2d do., Nellie Cotter, Jackson	1 00
Best crochet infant's shoes, Carrie H. Choate, Jackson	1 00
2d best lady's shoes, crochet or knit, Mrs. D. H. Ranney, Jackson	50
2d pair toilet mats, Carrie H. Choate, Jackson	50
Best skirt, crochet or knit, E. D. Sabin, Hudson	2 00
2d do., Carrie H. Choate, Jackson	1 00
Best shawl, crochet or knit, Mrs. J. C. Sharp, Jackson	3 00
2d do., Minnie R. De Puy, Jackson	2 00
Best specimen trimming, crochet or knit, Mrs. J. C. Sharp, Jackson	1 00
2d do., Mrs. Uri Isbell, Stockbridge	50
Best worsted tidy, Mrs. C. F. Knapp, Jackson	1 00
2d do., Mrs. E. S. Brownson, Jackson	50

MARY E. CHILD,
MRS. WILL. S. COBB,
Judges.

CLASS 67—HAIR, SHELL AND WAX WORK.

Best artificial flowers, in silk, muslin, paper or feathers, Mrs. A. S. Fish, Parma	$2 00
2d do., Mrs. Wm. Richards, Marshall	1 00
Best bouquet dried grasses, Mrs. Wm. Richards, Marshall	2 00
2d do., Elizabeth Kessler, Jackson	1 00
Best feather duster, Jno. A. Shelley, Jackson	1 00
Best feather fan, Z. A. Hartsuff, Unadilla	1 00
2d do., Margaret Trust, Jackson	50
Best display hair work, Mrs. D. J. Willson, Jackson	3 00
2d do., Mrs. Lucinda Cottrell, Jackson	2 00
Best display shell work, Kate Palen, Jackson	2 00
Best display wax flowers, Nellie Cotter, Jackson	2 00
2d best display wax fruit, Mrs. F. Rentsler, Ann Arbor	1 00
Best wreath of dried grasses or flowers, Margaret Trust, Jackson	2 00
2d do., Mrs. M. A. Chisholm, Marshall	1 00

EMMA J. RICE,
MRS. A. G. AMES,
Judges.

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DIVISION P—MISCELLANEOUS.

CLASS 68—MISCELLANEOUS ARTICLES.

Best specimen artificial stone or concrete, Geo. W. Stevens, Jackson	$2 00
Best collection fire brick, Jackson F. C. Tile Co., Jackson	3 00
Best barrel ground plaster, J. W. Flemming, Jackson	2 00
Best collection monumental work, C. W. Hill, Jackson	10 00
Best barrel stone lime, J. W. Flemming, Jackson	2 00
Best barrel stucco lime, J. W. Flemming, Jackson	2 00
Best specimen table salt, J. W. Flemming, Jackson	3 00
Best specimen water lime, J. W. Flemming, Jackson	2 00

JOHN M. OSBORN, *Judge.*

CLASS 69—HOUSEHOLD ARTICLES.

Best doz. brooms, Aldrich & Phillips, Jackson	$1 00
Best carpet stretcher, A. Dann, Cheboygan	1 00

JOHN M. OSBORN, *Judge.*

DIVISION Q—CHILDREN'S DEPARTMENT.

Best specimen hand sewing, Elizabeth Kessler, Jackson	$2 00
2d do., Miss M. G. Willson, Jackson	1 00
Best specimen patching, Elizabeth Kessler, Jackson	1 00
2d do., Nellie Cotter, Jackson	50
Best specimen darning, Elizabeth Kessler, Jackson	1 00
2d do., Blanche Barber, Jackson	50
Best patchwork quilt, by hand, in calico, Effie Crittenden, Jackson	1 00
Best calico dress, by hand, Lottie Stowe, Brooklyn	1 00
Best embroidery, in silk, Lottie Stowe, Brooklyn	1 00
Best sample crochet work, Jesse E. Snyder, Horton	1 00
2d do., Nellie Burnham, Jackson	50
2d sample knitting, Blanche Barber, Jackson	50
Best sample darned lace Mabel Hartsuff, Unadilla	1 00
Best specimen paper flowers, Mabel G. Willson, Jackson	50
2d do., Nellie Burnham, Jackson	25
Best collection pressed flowers, Elizabeth Kessler, Jackson	1 00
2d do., Blanche Barber, Jackson	50
Best collection autumn leaves, Elizabeth Kessler, Jackson	1 00
2d do., Willie Pomeroy, Jackson	50
Best bouquet wild flowers, Blanche Barber, Jackson	50
Best bouquet dried grasses, Elizabeth Kessler, Jackson	50
2d do., Mabel Hartsuff, Unadilla	25
Best collection postage stamps, Mabel Hartsuff, Unadilla	1 00
Best button string, Mabel Hartsuff, Unadilla	50
Best sample canned fruit, Blanche Barber, Jackson	1 00
2d do., Miss M. Frushard, Jackson	50
Best sample canned vegetables, Blanche Barber, Jackson	1 00
2d do., Miss M. Frushard, Jackson	50
Best sample jelly, Miss M Frushard, Jackson	1 00
2d do., Mabel Hartsuff, Unadilla	50
Best cage canaries, Mabel Hartsuff, Unadilla	1 00
2d do., Blanche Barber, Jackson	50
Best cage tamed birds, Mabel Hartsuff, Unadilla	1 00
Best map, by exhibitor, Edgar W. Adams, Jackson	50

Not Enumerated.

Best specimen drawn work, Lottie Stowe, Brooklyn	1 00
Best table scarf, in silk, Lottie Stowe, Brooklyn	1 00
Best tidy, in silk, Lottie Stowe, Brooklyn	50
Best collection cuttings, Chas. P. Kennedy, Jackson	50

MRS. J. C. SHARP,
MRS. HAYDEN,
Judges.

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DIVISION R—FRUITS AND FLOWERS.

CLASS 2—GENERAL COLLECTION FRUITS FOR FAMILY USE.

3d best collection, not more 100 varieties fruits for family use, by individual or society, W. C. Sheffer, South Haven	$20 00
2d best exhibit as above, by exhibitor, D. L. Garver, Hart	18 00

B. HATHAWAY,
H. G. REYNOLDS,
Judges.

CLASS 4—SPECIAL EXHIBIT APPLES FOR DESSERT AND CULINARY USES.

3d best exhibit, not more 35 varieties for dessert and culinary uses, by individual or society, Frank Aldrich, Liberty	$4 00
3d best exhibit of 20 varieties for dessert purposes, by individual or society, Frank Aldrich, Liberty	3 00

B. HATHAWAY,
H. G. REYNOLDS,
Judges.

CLASS 5—SPECIAL EXHIBIT MARKET APPLES.

2d best 15 varieties market apples by exhibitor, Frank Aldrich, Liberty	$3 00
3d do., Frank McGuffie, Leslie	2 00
2d best peck market apples, grown by exhibitor, C. R. Parsons, Saline	1 00
3d do., R. W. Mills, Saline	50

B. HATHAWAY,
H. G. REYNOLDS,
Judges.

CLASS 6—SPECIAL EXHIBIT PEACHES.

2d best exhibit peaches, not less 12 varieties by individual or society, W. C. Sheffer, South Haven	$8 00
3d do., H. F. Thomas, Jackson	5 00
3d best 8 varieties peaches, by exhibitor, H. F. Thomas, Jackson	3 00
Best peck peaches, by exhibitor, C. A. Sessions, Samons Landing	2 00

B. HATHAWAY,
H. G. REYNOLDS,
Judges.

CLASS 7—SPECIAL EXHIBIT PEARS.

Best exhibit, not more 20 varieties pears, by individual or society, W. C. Sheffer, South Haven	$10 00
2d do., Jos. Lannin, South Haven	7 00
3d do., Jos. Lannin, South Haven	4 00
Best 12 varieties market pears, by exhibitor, Jos. Lannin, South Haven	8 00
2d do. Jos. Lannin, South Haven	5 00
3d do., W. C. Sheffer, South Haven	3 00
Best peck pears, by exhibitor, Jos. Lannin, South Haven	2 00
2d do., Emil Bauer, Ann Arbor	1 00
3d do., John C. Sharp, Jackson	50

B. HATHAWAY,
H. G. REYNOLDS,
Judges.

CLASS 8—SPECIAL EXHIBIT PLUMS.

Best exhibit, not more 12 varieties plums, by individual or society, C. A. Sessions, Samon's Landing	$8 00
Best 6 varieties plums, by exhibitor, C. A. Sessions, Samon's Landing	5 00
Best peck plums for market, by exhibitor, C. A. Sessions, Samon's Landing	2 00

B. HATHAWAY, *Judge.*

CLASS 9—SPECIAL EXHIBIT GRAPES.

Best 5 varieties foreign grapes, by exhibitor, A. Sigler, Adrian	$5 00
2d do., A. Sigler, Adrian	3 00
Best 3 bunches, single variety foreign grapes, by exhibitor, A. Sigler, Adrian	1 00

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CLASS 10—SINGLE PLATES FRUIT.

Plate Apples.

Best plate Chenango, H. F. Thomas, Jackson	$0 75
2d do., Frank Aldrich, Liberty	50
Best plate Grimes' Golden, Frank Aldrich, Liberty	75
Best plate Hawley, Frank Aldrich, Liberty	75
Best plate Oakland, Frank Aldrich, Liberty	75
Best plate Primate, D. L. Garver, Hart	75
Best plate Peck's Pleasant, D. L. Garver, Hart	75
2d do., Frank Aldrich, Liberty	50
Best plate Swaar, Frank Aldrich, Liberty	75
Best plate Summer Pippin, H. F. Thomas, Jackson	75
2d do., Frank Aldrich, Liberty	50
Best plate Westfield, Frank Aldrich, Liberty	75

Crab Apples.

Best plate Hyslop, E. W. Allis, Adrian	75
2d do., Frank Aldrich, Liberty	50

Pears.

Best plate Bosc, Emil Bauer, Ann Arbor	75
2d do., Jos. Lannin, So. Haven	50
Best plate Bartlett, Carrie H. Choate, Jackson	75
2d do., Jos. Lannin, So. Haven	50
Best plate Beurre d 'Anjou, Jos. Lannin, So. Haven	75
2d do., Jos. Lannin, So. Haven	50
Best plate Clapp's Favorite, Jos. Lannin, So. Haven	75
2d do., A. O. Quick, Leoni	50
Best plate Flemish Beauty, D. L. Garver, Hart	75
2d do., Jos. Lannin, So. Haven	50
Best plate Gray Doyenne, Jos. Lannin, So. Haven	75
Best plate Louise Bonne de Jersey, Jos. Lannin, So. Haven	75
2d do., Jos. Lannin, So. Haven	50
Best plate Lawrence, Jos. Lannin, So. Haven	75
2d do., Jos. Lannin, So. Haven	50
Best plate Lucrative, Emil Bauer, Ann Arbor	75
Best plate Mt. Vernon, Emil Bauer, Ann Arbor	75
Best plate Nelis, Jos. Lannin, So. Haven	75
Best plate Rostiezer, Emil Bauer, Ann Arbor	75
2d do., E. W. Allis, Adrian	50
Best plate Seckel, Jos. Lannin, South Haven	75
2d do., Jos. Lannin, South Haven	50
Best plate Sheldon, Jos. Lannin, South Haven	75
2d do., Jos. Lannin, South Haven	50
Best plate Tyson, John C. Sharp, Jackson	75
Best plate White Doyenne, Jos. Lannin, South Haven	75
2d do., John C. Sharp, Jackson	50

Peaches.

Best plate George the Fourth, H. F. Thomas, Jackson	75
2d best plate Golden Drop, H. F. Thomas, Jackson	50
Best plate Snow, H. F. Thomas, Jackson	75

Non Enumerated.

Best plate Hale's Early, C. A. Sessions, Samon's Landing	75

Grapes.

Best plate Lady, H. F. Thomas, Jackson	75
Best plate Moore, Jos. Lannin, South Haven	75
2d do., H. F. Thomas, Jackson	50

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Best plate Niagara, Jos. Lannin, South Haven	$0 75
2d do., Jos. Lannin, South Haven	50
Best plate Pocklington, Jos. Lannin, South Haven	75
2d do., Frank Aldrich, Liberty	50
Best plate Worden, Frank Aldrich, Liberty	75

Non Enumerated.

Best plate Concord, H. Purdy, Jackson	75

Plums.

Best plate Damson, C. A. Sessions, Samon's Landing	75
Best plate Englebert, C. A. Sessions, Samon's Landing	75
2d best plate Green Gage, C. A. Sessions, Samon's Landing	50
Best plate Jefferson, C. A. Sessions, Samon's Landing	75
Best plate McLaughlin, C. A. Sessions, Samon's Landing	75
Best plate Union Purple, C. A. Sessions, Samon's Landing	75
Best plate Washington, C. A. Sessions, Samon's Landing	75

Quinces.

Best plate Orange, Mrs. J. C. Sharp, Jackson	75
2d do., John C. Sharp, Jackson	50

CHAS. ALFORD,
THOS. JEWETT,
Judges.

CLASS 11—DRIED, CANNED, PICKLED AND PRESERVED FRUITS AND JELLIES.

Best 8 named varieties domestic dried fruit, Mrs. H. C. Forbes, Kalamazoo	$10 00
2d do., Mrs. M. E. Bartlett, Tompkins	6 00
Best 8 named varieties domestic canned fruit, Mrs. H. C. Forbes, Kalamazoo	8 00
2d do., Mrs. A. Quithel, Rives Junction	4 00
3d do., Frank Aldrich, Liberty	2 00
4th do., Miss A. R. Cutting, Clinton	1 00
Best 8 named varieties pickled fruits, Mrs. H. C. Forbes, Kalamazoo	6 00
2d do., Mrs. M. E. Bartlett, Tompkins	4 00
3d do., Mrs. D. H. Ranney, Jackson	2 00
Best 8 named varieties domestic preserved fruits, Mrs. H. C. Forbes, Kalamazoo	6 00
2d do., Mrs. M. E. Bartlett, Tompkins	4 00
Best 10 named varieties domestic jellies, Mrs. H. C. Forbes, Kalamazoo	8 00
2d do., Mrs. M. E. Bartlett, Tompkins	5 00
3d do., Frank Aldrich, Liberty	3 00

ADDIE P. RANDALL,
G. L. FOOTE,
Judges.

CLASS 12—PLANTS AND FLOWERS, SHOWN IN BEDS.

Best ribbon bed of flowers in moss or sand, not to exceed 25 square feet, Wm. Bennett, Jackson	$12 00
Best bed of flowers in moss or sand, not to exceed 25 square feet, Wm. Bennett, Jackson	12 00
Best bed ornamental foliage plants in moss or sand, not to exceed 25 square feet, Wm. Bennett, Jackson	12 00
Best lawn flower bed in moss or sand, not to exceed 25 square feet, Wm. Bennett, Jackson	12 00

S. E. WATKINS,
G. L. FOOTE,
Judges.

CLASS 13—PLANTS IN POTS, PROFESSIONAL LIST.

Best collection greenhouse and stove plants, Jos. Blessing, Jackson	$20 00
Best 6 double geraniums, Jos. Blessing, Jackson	2 00

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Best 6 single geraniums, Jos. Blessing, Jackson	$2 00
Best 6 winter flowering begonias, Jos. Blessing, Jackson	2 00
Best specimen palm, Jos. Blessing, Jackson	1 00
Best specimen fern, Jos. Blessing, Jackson	1 00

S. E. WATKINS,
G. L. FOOTE,
Judges.

CLASS 14—PLANTS IN POTS, AMATEUR LIST.

Best 10 house plants, different varieties, Wm. Bennett, Jackson	$5 00
Best col., not less 10 diff. varieties, flowering plants, Wm. Bennett, Jackson	5 00
Best 6 varieties foliage plants, Wm. Bennett, Jackson	2 00
Best 6 single geraniums, Wm. Bennett, Jackson	2 00
Best 6 double geraniums, Wm. Bennett, Jackson	2 00
Best 6 coleus, Wm. Bennett, Jackson	2 00
Best 6 chrysanthemums, Wm. Bennett, Jackson	2 00
Best 6 winter begonias, Wm. Bennett, Jackson	2 00
Best 6 tuberous begonias, Wm. Bennett, Jackson	2 00
Best specimen abutilon, Wm. Bennett, Jackson	1 00
Best specimen salvia, Wm. Bennett, Jackson	1 00
Best specimen carnation, Wm Bennett, Jackson	1 00
Best specimen heliotrope, Wm. Bennett, Jackson	1 00

S. E. WATKINS,
G. L. FOOIE,
Judges.

CLASS 15—CUT FLOWERS, BOUQUETS AND FLORAL DESIGNS.

Best display cut flowers, Jos. Blessing, Jackson	$8 00
Best 6 varieties verbenas, Jos. Blessing, Jackson	2 00
2d do., Mrs. H. C. Forbes, Kalamazoo	1 00
Best 6 double dahlias, Mrs. H. C. Forbes, Kalamazoo	2 00
Best 6 single dahlias, Mrs. H. C. Forbes, Kalamazoo	1 50
Best 6 gladiolus, Mrs. H. C. Forbes, Kalamazoo	1 50
Best 6 bourbon or tea roses, Jos. Blessing, Jackson	2 00
Best bouquet of living flowers, Mrs. B. F. Murry, Jackson	3 00
2d do., Mrs. H. C. Forbes, Kalamazoo	2 00
Best bouquet of dried grasses, Mrs. M. A. Chisholm, Marshall	2 00
2d do., Elizabeth Kessler, Jackson	1 00
Best bouquet of dried everlastings, Margaret Trust, Jackson	1 00
Best living flowers, in vases, Mrs. H. C. Forbes, Kalamazoo	2 00
2d do., Jos. Blessing, Jackson	1 00
Best floral design in living flowers, Jos. Blessing, Jackson	10 00
Best basket of cut flowers, Jos. Blessing, Jackson	8 00

Non-enumerated.

Best cactus, Mrs. E. W. Raplee, Jackson	50

S. E. WATKINS,
G. L. FOOTE,
Judges.

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REPORTS FROM LOCAL SOCIETIES.

ANTRIM COUNTY AGRICULTURAL SOCIETY.

To the Secretary of the State Board of Agriculture, Lansing, Michigan:

DEAR SIR,—We herewith submit our report of the transactions of the Antrim County Agricultural Society for the year ending December 20, 1887:

RECEIPTS.

From county appropriation	$320 00
6th annual fair of 1887	247 56
cash on hand at beginning of year	63 75
Total	$631 31

DISBURSEMENTS.

Paid premiums awarded 1886 and 1887	$281 24
outstanding indebtedness and incidental expenses	264 84
Balance cash on hand	85 23
	$631 31

Classification of premiums awarded at 6th annual fair held at Bellaire, Michigan, Sept. 28, 29, and 30, 1887:

Division A.

Horses—Class 1, Roadsters	$15 00
" 2, General use	17 50
" 3, Draft	16 50
" 4, Teams	21 00
" 5, Single horses	12 00
" 6, Mules	4 00
Cattle—Class 7, Shorthorns	4 00
" 8, No entries.	
" 9, Jerseys	5 00
" 10, Grades	8 50
" 11, Working oxen	13 00
" 12, Trained steers	5 00
" 12½, Holsteins	7 00

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Sheep—	" 13, Merino, no entries.	
	" 14, Long wools	$8 50
	" 15, No entries.	
	" 15½,	4 50
Swine—	" 16, Polands	5 50
	" 17, Chester Whites	3 00
	" 18, No entries.	
	" 19, No entries.	
	" 20, All other breeds	5 00
Poultry and pet stock—Class 21, Pure bred fowls		1 50
	" 22, Turkeys, geese and ducks	1 00

Division B.

Machinery, etc.,—Diplomas.	
Vehicles—Diplomas.	
Mechanic Arts—Diplomas.	
Grain—Class 26	7 75
Vegetables—Class 27	8 25

Division C.

Fruit—Class 29, Apples	11 50
" 30, Pears	1 25
" 31, Peaches	25
" 32, Plums	25
" 33, Grapes	1 00
" 34, Miscellaneous fruits	1 25
Flowers—Class 35	3 75
Household and dairy products—Class 36	6 50
Ornamental and domestic work—Class 37	14 00
Fine arts—Class 38, Diplomas.	
Musical instruments and sewing machines—Class 39	2 50
Amateur arts—Class 40, Diplomas.	
Boys' and girls' department—Class 41	5 75
Total amount of premiums awarded	$221 50

All of which is respectfully submitted.

ROBERT R. WILKINSON, *President.*
CHARLES S. GUILE, *Secretary.*
JOHN A. HARRIMAN, *Treasurer.*

Dated December 20, 1887.

AMENDMENT TO ARTICLES OF ASSOCIATION OF THE ANTRIM COUNTY AGRICULTURAL SOCIETY.

BELLAIRE, Michigan, January 4, 1887.

We the undersigned, President and Secretary of the Antrim County Agricultural Society, hereby certify that at the annual meeting of said society, held at Bellaire, Michigan, on the third day of January A.D. 1887, previous notices having been duly given as pro-

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vided by law, and more than two-thirds of the members present voting therefor, the following amendment to article three of the articles of association of said Society was adopted, to wit: By striking out the words "On the first Monday in January" and inserting in their stead the words "On the second day of the annual Fair at seven o'clock P.M., and all officers' terms of office shall commence on the first day of January of each year," so that the article as amended reads as follows:

ARTICLE III.—The officers of the Society shall consist of a president, secretary, and treasurer who shall be elected annually by ballot on the second day of the annual Fair at seven o'clock P.M., and all officers' terms of office shall commence on the first day of January of each year, and six directors who shall be elected at the first election of officers—two for one year, two for two years, and two for three years, and two directors shall be elected annually thereafter.

ROBERT R. WILLIAMSON, *President.*
CHARLES S. GUILE, *Secretary.*

MANISTEE COUNTY AGRICULTURAL SOCIETY.

This Society held its Annual Fair at Onekama September 20–22, 1887.

Considering the dry season the display of grain and vegetables was very good. The fruit exhibited was large and very fine. Live stock was hardly up to former years. The Society has purchased twenty acres on the east side of Portage Lake and got them enclosed.

RECEIPTS.

Life membership tickets	$680 00
Yearly membership tickets	267 00
Licenses for stands, etc.	76 00
Gate receipts	197 10
Rent of grounds at Bear Lake	20 00
Total	$1,240 10

Paid on grounds	$200 00
Paid treasurer	575 08
Paid clerk hire and gate keepers	18 00
Paid for lumber, buildings, fencing and labor on grounds	441 77
Postage and incidentals	5 25
Total	$1,240 10

OFFICERS FOR 1888.

President—Henry A. Danville, Marilla.
Secretary—John N. Brodie, Bear Lake.
Treasurer—Leo. F. Hale, Bear Lake.

JOHN N. BRODIE,
Secretary.

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SUMMARY OF METEOROLOGICAL OBSERVATIONS AT THE MICHIGAN AGRICULTURAL COLLEGE, FOR THE YEAR 1887.

BY R. C. KEDZIE, PROFESSOR OF CHEMISTRY.

[Latitude 42° 43′ 56″, longitude 7° 25′ 59.61″, height above the sea 834 feet.]

	Mean Daily Temperature in the Open Air.	Percentage of Humidity. Saturation=100.	Pressure of Vapor of Water in Inches of Mercury.	Height of Barometer, reduced to Temperature of 32° F.	Percentage of Cloudiness.	Amount of Rain and Melted Snow in Inches.	Snow fall in Inches.	Number of Thunderstorms.
January	18°.20	90	.103	29.000	71	3.25	16	.....
February	24°.26	89	.127	29.176	78	5.71	10	.....
March	28°.29	78	.124	29.118	54	1.78	9	.....
April	45°.37	66	.204	29.048	58	.90	3½	.....
May	61°.28	68	.401	29.096	36	2.42	.....	8
June	68°.53	73	.500	29.107	47	2.47	.....	8
July	75°.51	65	.556	29.104	36	1.50	.....	9
August	67°.96	66	.427	29.117	48	.89	.....	.....
September	58°.86	75	.373	29.200	48	4.72	.....	8
October	44°.97	75	.237	29.103	60	1.86	.....	.....
November	35°.66	80	.161	29.096	53	2.28	2½	.....
December	27°.30	87	.131	29.096	74	3.32	13	.....
Year	46°.60	76	.279	29.105	55	31.10	57	42

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Meteorological Observations for the Month of

Day of Month.	Thermometer in Open Air.				Relative Humidity or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1.....	9	18	7	11½	100	84	100	.065	.082	.060	29.098	29.120	29.173	29.130
2.....	-10	12	-1	½	100	80	100	.028	.060	.042	29.305	29.353	29.428	29.362
3.....	7	9	-1	5	77	57	100	.045	.036	.042	29.574	29.568	29.582	29.575
4.....	6	17	15	12⅝	100	67	100	.057	.063	.086	29.437	29.242	29.138	29.272
5.....	18	20	15	17⅝	100	85	100	.098	.091	.086	29.154	29.188	29.258	29.200
6.....	8	19	8	11⅝	100	100	100	.062	.108	.062	29.201	29.180	29.285	29.222
7.....	-24	13	-11	-7⅝	100	61	100	.015	.045	.027	29.409	29.505	29.525	29.480
8.....	-1	11	3	4⅓	68	100	100	.042	.071	.050	29.509	29.438	29.428	29.458
9.....	7	14	7	9⅓	100	100	100	.060	.082	.060	29.108	28.884	28.817	28.966
10.....	5	10	-5	3⅓	100	79	100	.055	.054	.035	28.928	28.901	28.960	28.930
11.....	-10	20	23	10⅝	100	70	86	.028	.075	.101	28.829	28.625	28.600	28.685
12.....	25	28	24	25⅝	87	77	74	.117	.117	.094	28.544	28.682	28.908	28.713
13.....	18	29	26	24⅓	100	78	88	.098	.123	.123	28.907	28.790	28.667	28.785
14.....	22	26	18	22	100	100	100	.118	.141	.098	28.259	28.562	28.787	28.536
15.....	22	24	23	23⅓	100	100	100	.118	.129	.118	28.937	28.926	28.988	28.950
16.....	23	28	25	25⅓	100	100	100	.123	.153	.135	28 975	28.784	28.687	28.815
17.....	26	23	10	19⅝	88	86	79	.123	.106	.054	28.559	28.765	28.915	28.713
18.....	-5	8	-4	-⅓	100	100	100	.035	.062	.086	29.217	29.260	29.204	29.234
19.....	12	26	23	20⅓	100	63	86	.075	.088	.106	28.803	28.795	28.852	28.817
20.....	40	44	30	38	73	100	100	.182	.218	.167	28.407	28.330	28.732	28.490
21.....	23	28	26	25⅓	86	77	100	.101	.117	.141	29.345	29.285	29.125	29.252
22.....	44	43	45	44	100	100	100	.299	.278	.300	28.952	28.935	28.870	28.919
23.....	33	46	32	37	100	92	89	.188	.286	.162	28.762	28.685	28.735	28.727
24.....	22	35	26	27⅝	100	70	88	.118	.142	.123	28.925	28.924	28.957	28.935
25.....	40	35	25	33⅓	56	70	100	.139	.142	.135	28.617	28.885	28.972	28.825
26.....	8	19	10	12⅓	100	54	100	.062	.055	.068	29.255	29.360	29.423	29.346
27.....	17	34	29	26⅝	83	70	89	.078	.138	.142	29.282	29.172	29.083	29.179
28.....	39	39	32	36⅝	68	91	69	.110	.216	.126	28.753	28.625	28.785	28.721
29.....	25	41	34	33⅓	100	100	80	.135	.257	.170	28.912	28.798	28.708	28.806
30.....	20	11	0	10⅓	100	100	100	.108	.071	.044	28.687	28.812	28.990	28.830
31.....	0	3	1	1⅓	100	100	100	.044	.052	.048	29.196	29.188	29.082	29.155
Sums....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Means...	.....	.....	.....	18°.20	93	84	90	.094	.118	.098	.....	.....	.....	29.000
Average.....						90			.103					

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January, 1887, at Agricultural College, Michigan.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning Rain or Snow.	Ending Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
10	St.	20	Cir.Cu.	100	St.	n w	2	n w	8	n	4	18	-14	.....	.....	.....	.....
90	St.	80	Cir. St.	00	.....	w	1	n w	6	....	0	16	-10	.....	.....	.....	.....
100	St.	10	Cir.Cu.	20	Cir. St.	s w	8	s w	12	s w	4	13	-3	.....	.....	.....	.....
100	St.	100	St.	100	St.	s	8	s	12	s	6	18	6	.....	.....	.....	.....
100	Nim.	100	St.	100	St.	s w	12	s w	8	s w	4	22	6	In night.	.....	.05	⅛
100	St.	60	St.	90	Cu. St.	s w	4	n w	4	n w	5	19	-26	.....	.....	.....	.....
10	St.	40	Cir. St.	00	.....	....	0	n	3	....	0	14	-24	.....	.....	.....	.....
100	St.	100	Nim.	80	Cir. St.	n	1	n e	1	n e	1	11	-1	.....	.....	.....	.....
100	Nim.	100	Nim.	100	St.	n e	1	n e	3	w	2	14	-5	3 a. m.	3 p. m.	.20	3
100	Nim.	90	St.	20	Cir.	s w	2	s w	9	s w	12	10	-11	7 a. m.	11 a. m.	.05	1
00	.....	100	St.	100	St.	s w	18	s w	2	s w	16	25	-10	.....	.....	.....	.....
100	St.	100	St.	100	St.	s w	12	w	10	w	4	28	16	.....	.....	.....	.....
100	St.	100	St.	100	Nim.	n e	6	e	10	n e	12	29	18	3 p. m.	.....	1.00	10
100	Nim.	100	Nim.	100	Nim.	n	5	n w	8	....	0	26	17	.....	.....	.15	1½
100	St.	100	St.	100	St.	w	4	s w	12	s	4	30	20	.....	.....	.....	.....
100	Nim.	100	Nim.	80	St.	s	1	e	6	n e	2	28	22	.....	.....	.....	.....
100	Nim.	90	Cir. St.	100	St.	w	20	n w	20	w	12	31	-6	.....	.....	.....	.....
00	.....	10	St.	80	St.	s w	8	w	3	w	12	12	-5	.....	.....	.....	.....
90	St.	70	Cir.Cu.	80	St.	s w	16	s w	8	....	0	40	12	.....	.....	.....	.....
100	St.	100	St.	00	.....	s	24	s w	28	w	20	45	21	.....	.....	.....	.....
100	St.	40	Cir. St.	100	Nim.	n w	3	s	8	s	12	44	22	.....	.....	.....	.....
90	Cu. St.	100	Nim.	100	Nim.	s	12	w	1	s w	12	45	33	8 a. m.	.....	1.40	.....
100	Nim.	100	Nim.	100	Nim.	n e	6	s w	8	s w	12	46	22	.....	10 p. m.	.40	.....
50	St.	10	St.	40	St.	w	4	w	6	w	6	40	22	.....	.....	.....	.....
50	St.	100	Cu. St.	100	Nim.	s w	16	w	8	n e	12	40	8	.....	.....	.....	.....
90	St.	20	St.	00	.....	n	6	w	3	w	22	19	8	.....	.....	.....	.....
100	St.	10	Cu. St.	40	St.	s	7	s w	20	s	12	39	17	.....	.....	.....	.....
100	Cu. St.	100	Nim.	00	.....	s	16	s	20	s w	8	40	25	.....	.....	.....	.....
00	.....	20	Cir.Cu.	100	St.	....	0	s w	24	s w	8	41	20	.....	.....	.....	.....
100	Nim.	30	Cir. St.	40	Cir. St.	w	4	w	20	s w	7	20	-1	.....	.....	.....	.....
100	Nim.	100	Nim.	50	Cir.Cu.	e	2	n e	6	n w	3	8	-12	.....	.....	.....	.....
....	.....	....	.....	....	.....	....	....	....	....	....	....	.....	.....	.....	.....	3.25	16.0
80	.....	69	.....	64	.....	....	....	....	....	....	....	.....	.....	.....	.....	.....	.....
				71													

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Meteorological Observations for the Month of

Day of Month.	Thermometer in Open Air.				Relative Humidity, or Per Cent. of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 P. M.	2 P. M.	9 P. M.	Mean.
1.	-1	10	9	6	109	79	100	.044	.054	.068	29.588	29.535	29.472	29.548
2.	14	21	21	18½	82	86	100	.070	.096	.118	29.185	29.074	28.990	29.083
3.	22	23	12	18⅝	100	100	100	.123	.123	.075	29.185	29.285	29.293	29,154
4.	3	18	5	8⅝	100	85	100	.053	.097	.057	29.689	29.778	29.773	29.745
5.	11	18	20	16½	100	85	100	.071	.087	.103	29.691	29.543	29.491	29.575
6.	32	34	32	32⅝	100	90	100	.181	.175	.181	29.345	29.275	29.297	29.305
7.	32	38	43	37⅝	100	100	100	.181	.229	.278	29.220	29.107	29.072	29.133
8.	50	42	31	41	100	83	79	.361	.222	.136	28.755	28.828	29.110	28,897
9.	21	38	31	30	100	81	89	.113	.186	.155	29.445	29.386	29.203	29.374
10.	35	44	35	38	80	92	100	.102	.205	.204	28.968	28.783	28.727	28.839
11.	23	23	13	19½	100	86	80	.123	.089	.060	28.479	28.740	29.175	28.798
12.	10	15	8	13	100	100	78	.068	.086	.048	29.430	29.510	29.632	29.524
13.	4	22	15	13⅝	100	58	100	.052	.068	.086	29.720	29.649	29.591	29.653
14.	21	35	35	30½	86	70	90	.096	.142	.183	29.357	29.159	29.085	29.200
15.	34	35	31	33½	100	80	89	.196	.162	.155	29.102	29.120	29.105	29.109
16.	28	33	24	29	77	61	100	.117	.113	.129	28.998	29.002	29.027	29.009
17.	21	34	31	28⅝	100	70	100	.113	.138	.174	29.038	28.985	28.717	28.913
18.	39	33	27	32½	100	100	76	.238	.188	.111	28.260	28.253	28.537	28.350
19.	23	26	23	24	86	75	86	.106	.105	.106	28 900	29.062	29.218	29.060
20.	21	28	23	23⅝	86	78	100	.096	.117	.118	29.279	29.228	29.310	29.270
21.	23	30	26	26½	100	78	88	.123	.130	.123	29.456	29.420	29.365	29.447
22.	28	31	29	27⅝	100	79	89	.123	.136	.142	29.564	29.643	29.543	29.583
23.	24	35	30	29⅝	87	61	100	.111	.127	.167	29.393	29.065	28.868	29.108
24.	26	25	10	20½	88	75	100	.123	.100	.068	29.067	29.264	29.430	29.253
25.	7	26	25	19½	78	63	75	.045	.088	.100	29.443	29.383	29.183	29.303
26.	34	38	20	30⅝	90	81	100	.175	.186	.108	28.597	28.299	28 517	28.804
27.	12	14	12	12⅝	100	83	100	.075	.067	.075	28.078	28.925	29.155	28.919
28.	6	25	28	19½	100	62	86	.057	.082	.135	29.391	29.236	29.000	29.209
29.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
30.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
31.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sums.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Means.	.....	.....	.....	24. °26	94	80	93	.122	.130	.123	.....	.....	.....	29.176
Average.						89			.127					

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February, 1887, at Agricultural College, Michigan.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow. Inches.
80	Cu. St.	100	Nim.	100	Nim.	n e	1	e	8	n e	8	15	0	.....	.....	.....	.....
100	Nim.	100	Nim.	100	Nim.	e	4	e	1	s e	1	32	14	.....	.....	.....	.....
100	Nim.	100	Nim.	00	Cu. St.	n	1	n w	8	n w	4	25	2	7 a. m.	4 p. m.	.40	4
50	Cu. St.	60	Cu. St.	80	Cu. St.	n w	2	n w	11	n	4	34	1	.....	.....	.....	.....
100	Nim.	100	Nim.	100	St.	e	6	s e	4	s e	6	32	11	5 p. m.	.....	.40	.....
100	Nim.	100	Nim.	100	Nim.	s w	1	w	2	w	1	34	30	.....	.....	.70	.....
100	Nim.	100	Nim.	100	Nim.	e	1	s e	2	s	12	50	32	.....	.....	.65	.....
100	Nim.	90	Cu. St.	00	.....	s w	16	w	20	w	16	52	21	.....	1 p. m.	.50	.....
00	.....	30	Cir.	10	St.	n w	2	s w	12	s	5	38	21	.....	.....	.....	.....
50	St.	100	Nim.	100	Nim.	s w	8	s w	2	n e	12	44	23	2 p. m.	.....	.....	.....
100	Nim.	60	Cu. St.	100	St.	n e	8	n e	12	n	8	25	8	.....	12 m.	1.30	3
100	St.	100	St.	100	St.	n e	1	n	12	w	4	20	3	.....	.....	.....	.....
80	St.	00	.....	20	St.	s	1	s	5	s e	6	23	4	.....	.....	.....	.....
80	St.	100	Nim.	100	Nim.	s	10	s	8	s w	6	35	21	2 p. m.	.....	.....	.....
100	Nim.	100	Cu. St.	100	St.	w	2	w	1	....	0	35	28	.....	9 a. m.	.40	.....
100	Cu. St.	20	Cu.	00	.....	w	16	s w	20	w	1	33	20	.....	.....	.....	.....
10	St.	100	St.	100	Nim.	e	4	e	12	e	8	39	21	3 p. m.	.....	.72	.....
100	Fog.	100	Nim.	100	Nim.	s e	6	s w	20	w	24	41	23	.....	.....	.10	.....
100	Nim.	100	St.	100	St.	w	16	w	8	w	2	26	20	.....	10 a. m.	.01	.....
100	St.	90	Cu. St.	10	St.	n e	3	e	1	e	1	28	19	Snow	squalls	.03	½
100	St.	100	Cu. St.	100	St.	e	1	e	1	e	1	30	22	In night.	.....	.05	½
100	St.	100	St.	100	St.	n e	1	....	0	....	0	31	22	.....	.....	.....	.....
80	Cu. St.	100	Cu. St.	100	St.	s e	5	s e	2	e	8	35	23	11 p. m.	12 p. m.	.15	1
50	Cu. St.	50	Cu.	00	.....	w	12	w	16	....	0	29	3	.....	.....	.....	.....
10	Cir.	80	Cir. St.	100	St.	e	4	e	8	e	16	36	7	10 p. m.	.....	.....	.....
100	Nim.	100	Nim.	50	Cu. St.	s e	16	s w	20	w	24	38	12	.....	.....	.....	.....
100	Nim.	80	Cu. St.	00	.....	n w	28	w	28	w	12	19	4	.....	9 a. m.	.25	1
10	St.	100	St.	90	St.	....	0	s w	6	s w	6	28	6	4 p. m.	6 p. m.	.05	½
----	.....	----	.....	----	.....	----	----	----	----	----	----	.....	.....	.....	.....	.....	.....
----	.....	----	.....	----	.....	----	----	----	----	----	----	.....	.....	.....	.....	.....	.....
----	.....	----	.....	----	.....	----	----	----	----	----	----	.....	.....	.....	.....	.....	.....
----	.....	----	.....	----	.....	----	----	----	----	----	----	.....	.....	.....	.....	5.71	10
78	.....	85	.....	72	.....	----	----	----	----	----	----	.....	.....	.....	.....	.....	.....
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Meteorological Observations for the Month of

Day of Month.	Thermometer in Open Air.				Relative Humidity, or Per Cent. of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	20	42	38	33½	100	58	81	.108	.155	.186	29.015	29.027	28.915	28.985
2	42	47	30	39⅝	83	48	47	.222	.156	.076	28.778	28.957	29.255	28.986
3	23	31	28	27½	100	69	100	.123	.118	.152	29.396	29.435	29.452	29.428
4	15	28	18	20½	100	66	100	.186	.099	.098	29.576	29.633	29.689	29.633
5	17	23	26	22	100	86	100	.094	.106	.141	29.432	29.145	29.062	29.216
6	33	32	38	36½	100	91	81	.188	.208	.186	28.872	28.895	28 963	28.910
7	34	47	32	37⅝	90	55	89	.175	.179	.162	29.045	29.170	29.285	29.167
8	26	46	38	36⅝	100	54	72	.141	.169	.165	29.376	29 248	29.155	29.260
9	39	50	32	40½	73	72	89	.173	.258	.162	28.928	28.970.	29.115	29.004
10	25	38	28	30½	87	72	100	.117	.165	.153	29.226	29.313	29.355	29.301
11	25	36	32	31	100	61	89	.135	.129	.162	29.420	29.420	29.396	29.412
12	32	49	38	39⅝	79	44	81	.143	.152	.186	29.316	29 255	29.132	29.234
13	35	28	16	26½	80	77	33	.162	.117	.074	28.955	29.027	29.195	29.059
14	17	28	23	22⅝	83	54	73	.078	.082	.089	29.311	29.297	29.205	29.271
15	18	33	27	26	84	32	53	.082	.057	.076	29.065	28.972	28.952	28.996
16	21	37	26	28	29	23	88	.032	.047	.123	28.935	28.907	28.952	28.931
17	20	21	17	19½	70	57	83	.075	.064	.078	28.952	28.972	29.037	28.987
18	19	34	28	25½	85	70	88	.087	.138	.135	29.043	29.030	29.055	29.043
19	23	43	30	32	73	43	89	.089	.127	.148	29.105	29.093	29 155	29.084
20	27	47	39	37⅝	100	48	73	.147	.156	.173	29.171	29.098	29.085	29.100
21	32	36	33	33⅝	100	90	100	.181	.191	.188	29.008	28.987	29.007	29.001
22	23	28	22	24½	74	100	86	.094	.153	.106	28.992	29.085	28.998	29.025
23	16	37	32	28½	100	45	100	.090	.103	.181	29.042	28.937	28.900	28.959
24	37	42	32	37	71	83	100	.157	.222	.181	28.615	28.467	28.680	28.587
25	14	32	20	22	100	59	100	.082	.106	.108	29.072	29.060	29.178	29.110
26	16	31	20	22½	83	38	100	.074	.064	.108	29.361	29.346	29.280	29.329
27	16	22	20	19½	100	100	100	.090	.118	.108	29.206	28.880	28.880	28.989
28	10	25	12	15⅝	100	75	80	.068	.100	.060	28.987	29.004	29.062	29.331
29	6	22	13	13⅝	76	45	81	.043	.052	.063	29.115	29.150	29.205	29.157
30	6	29	20	18½	76	56	100	.043	.087	.108	29 246	29.221	29.225	29.231
31	15	43	28	28⅝	100	21	88	.086	.058	.135	29.204	29.183	29.180	29.189
Sums														
Means				28.°29	87	61	87	.115	.127	.131				29.118
Average						78			.124					

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March, 1887, at Agricultural College, Michigan.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow. Inches.
10	St.	20	Cir. St.	00	.....	....	0	....	0	s	1	42	20	.....	.....	.....	.....
00	.....	50	Cu. St.	30	St.	....	0	n e	12	n e	7	50	28	.....	.....	.....	.....
90	St.	90	St.	100	St.	n e	2	n e	1	....	0	31	16	.....	.....	.....	.....
00	.....	20	Cu.	30	Cir. St	n	3	n e	8	n e	12	28	12	.....	.....	.....	.....
100	Nim.	100	Nim.	100	Nim.	e	8	e	5	e	1	33	17	7 a. m.	.....	.....	2
100	Nim.	100	St.	100	St.	e	2	w	5	w	5	38	33	.....	11 a. m.	.75	.....
70	Cu. St.	30	Cir. St.	30	St.	w	5	w	12	w	2	47	23	.....	.....	.....	.....
10	St.	10	St.	30	St.	....	0	s e	12	s e	12	46	26	.....	.....	.....	.....
80	Cu. St.	100	Cu. St.	10	St.	s	6	n w	8	....	0	53	23	.....	.....	.....	.....
40	St.	100	St.	100	St.	n	4	n	5	n e	4	41	22	.....	.....	.....	.....
90	St.	30	St.	100	St.	e	4	s e	5	....	0	37	23	.....	.....	.....	.....
100	Cu. St.	00	.....	100	St.	s e	7	s	12	s e	12	50	32	.....	.....	.....	.....
100	Cu. St.	100	Nim.	100	Nim.	w	16	n w	24	n w	12	35	15	1 p. m.	9 p. m.	.08	½
100	Cu. St.	20	Cir. St.	30	St.	n	6	n e	4	....	0	30	18	.....	.....	.....	.....
90	St.	30	Cir. St.	50	St.	n	1	n	6	w	8	35	17	.....	.....	.....	.....
70	St.	20	St.	20	St.	n	8	n w	12	n e	8	38	17	.....	.....	.....	.....
00	.....	100	Cu. St.	10	St.	n w	16	n w	12	n e	7	24	15	.....	.....	.....	.....
100	St.	80	Cu. St.	100	St.	n	1	w	12	n w	7	36	19	.....	.....	.....	.....
30	St.	20	Cu.	00	.....	n	6	n w	12	....	0	43	21	.....	.....	.....	.....
20	St.	40	Cu.	100	St.	....	0	s w	8	....	0	51	27	.....	.....	.....	.....
100	Nim.	100	Nim.	20	St.	e	8	n	8	w	12	37	20	7 a. m.	.....	.....	.....
100	Nim.	100	Nim	100	St.	n w	12	n w	12	n w	7	30	12	.....	5 p. m.	.10	.....
00	.....	40	Cu.	00	.....	w	2	s w	12	s w	8	40	16	.....	.....	....	.....
100	St.	100	Nim.	100	Nim.	s	12	n e	7	n e	12	48	10	1 p. m.	10 p. m.	.50	2
10	St.	40	Cu. St.	10	St.	s w	4	w	16	w	3	32	12	.....	.....	.....	.....
00	.....	20	Cir. St.	100	Nim.	e	4	n e	8	n e	7	33	15	In night.	.....	.15	2
100	St.	100	Nim.	100	Nim.	e	12	n e	12	n e	8	27	9	1 p. m.	10 p. m.	.25	2½
20	Cir. St.	100	St.	00	.....	n w	8	n w	12	....	0	35	2	.....	.....	.....	.....
00	.....	50	Cu.	00	.....	n w	6	w	4	w	4	25	-1	.....	.....	.....	.....
30	St.	20	St.	10	St.	w	1	s w	2	...	0	31	6	.....	.....	.....	.....
00	.....	10	St.	50	St.	....	0	e	1	...	0	42	15	.....	.....	.....	.....
----	-----	----	-----	----	-----	----	----	----	----	----	----	-----	-----	-----	-----	1.78	9
54	.....	56	.....	53	.....	....	....	....	...	....	....	.....	.....	.....	.....	.....	.....
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Meteorological Observations for the Month of

Day of Month.	Thermometer in Open Air.				Relative Humidity or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	28	49	33	36½	77	37	79	.117	.130	.150	29.153	29.090	29.092	29.112
2	32	56	41	43	89	40	74	.162	.179	.190	29.065	29.007	28.995	29.022
3	45	65	54	53½	68	44	74	.204	.272	.308	28.923	28.767	28.692	28.796
4	34	28	18	26½	79	100	100	.155	.153	.098	28.765	28.833	29.063	28.887
5	19	36	27	27½	85	89	76	.087	.077	.111	29.120	29.285	29.376	29.260
6	27	40	31	32½	76	89	100	.111	.097	.174	29 418	29.381	29.393	29.397
7	32	48	36	38½	89	36	53	.162	.120	.115	29.461	29.505	29.531	29.399
8	34	63	44	47	79	33	92	.155	.189	.265	29.546	29.461	29.443	29.483
9	53	76	63	63½	60	38	56	.232	.336	.312	29.409	29.330	29.318	29.352
10	57	76	61	64½	52	31	50	.242	.273	.209	29.286	29.178	29.135	29.200
11	56	48	37	37	63	78	81	.283	.260	.178	29.213	29.253	29.285	29.250
12	37	75	53	55	81	44	80	.178	.383	.321	29.103	29.185	29.188	29.158
13	45	68	43	52	76	47	83	.228	.591	.231	29.306	29.235	29.231	29.257
14	41	73	53	55½	91	38	93	.235	.296	.375	29.164	28.987	29 002	29.051
15	56	62	44	54	87	56	92	.391	.313	.265	28.815	28.758	28 797	28.800
16	37	50	35	40½	81	45	61	.178	.163	.127	28.975	29.033	29.097	29.035
17	34	49	39	40½	70	85	46	.139	.297	.110	29.108	29.050	29.002	29.053
18	33	41	31	35	79	49	58	.150	.126	.100	28.787	28.767	28.947	28.834
19	31	57	43	37½	79	20	51	.136	.094	.142	29.055	29.052	29.097	29.068
20	43	55	46	48	59	45	77	.164	.193	.238	29.078	29.032	29.042	29.051
21	44	65	55	54½	93	26	45	.265	.163	.219	29.098	29.112	29.062	29.091
22	47	58	55	51½	85	80	87	.273	.348	.376	28.903	28.703	28.524	28.710
23	37	36	32	35	81	71	79	.178	.149	.143	28.493	28.733	28.868	28.706
24	36	44	35	38½	71	87	90	.149	.108	.183	29.005	28.981	28.972	28.986
25	34	47	43	41½	70	41	51	.138	.133	.142	28.970	28.937	28.887	28.931
26	36	50	36	40½	90	32	61	.191	.117	.129	28.912	28.962	29.006	28.960
27	37	54	44	48½	90	49	68	.199	.206	.196	29.008	28.995	28.927	28.977
28	45	59	45	49½	92	76	76	.275	.330	.228	28.533	28.439	28.532	28.518
29	42	53	45	46½	74	48	84	.190	.194	.251	28.817	28.917	29.027	28.920
30	43	58	55	53	75	32	39	.209	.153	.103	29.135	29.077	29.007	29.073
31														
Sums														
Means				45°.37	78	48	72	.193	.216	.204				29.048
Average						66			.204					

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April, 1887, at Agricultural College, Michigan.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning Rain or Snow.	Ending Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
70	Cu. St.	20	Cu. St.	00	.....	s	3	s	2	...	0	48	28	.....	.....	.....	.....
90	Cu. St.	30	Cu.	00	.....	s	4	s w	6	....	0	56	32	.....	.....	.....	.....
80	St.	100	St.	100	St.	s	5	s	8	s	12	68	34	.....	.....	.....	.....
100	Cu. St.	100	Cu. St.	100	Cu. St.	w	20	w	24	w	20	34	14	.....	.....	.....	.....
80	Cu. St.	10	St.	00	.....	n w	16	w	3	w	3	39	19	.....	.....	.....	.....
100	St.	100	St.	100	Nim.	e	6	e	6	e	3	40	26	5 p. m.	10 p. m.	.25	3
100	Cu. St.	00	.....	10	St.	e	4	n e	7	e	1	48	30	.....	.....	.....	.....
00	.....	20	Cir.	00	.....	se	5	s	7	s	3	63	34	.....	.....	.....	.....
00	.....	40	Cu. St.	00	.....	s	12	s w	12	s w	7	76	49	.....	.....	.....	.....
00	.....	10	Cir.	60	St.	s w	12	s w	20	s w	8	76	52	.....	.....	.....	.....
50	St.	100	Nim.	50	Cir.	s w	3	s w	12	n e	5	70	32	.....	.....	.....	.....
50	St.	00	.....	60	St.	e	7	s	5	....	....	75	36	.....	.....	.....	.....
70	St.	Sm	oky.	00	.....	se	8	se	9	se	4	70	38	.....	.....	.....	.....
Sm	oky.	90	Cu. St.	50	Cu. St.	se	4	se	12	se	8	75	41	.....	.....	.....	.....
60	Cu. St.	80	Cu. St.	100	Nim.	s w	8	w	22	w	12	72	37	5 p. m.	10 p. m.	.10	.....
100	Cu. St.	50	Cu.	00	.....	n	12	n w	12	n	8	52	23	.....	.....	.....	.....
70	St.	80	Cir. St.	100	St.	e	3	n e	3	n e	5	51	32	.....	.....	.....	.....
100	St.	100	St.	00	.....	n e	12	n	20	....	0	42	23	.....	.....	.....	.....
00	.....	10	Cu.	00	.....	w	8	n	8	....	0	57	31	.....	.....	.....	.....
100	St.	100	St.	00	.....	s w	4	n w	12	s w	3	57	39	.....	.....	.....	.....
00	.....	50	Cu.	90	St.	s w	4	s	8	....	0	66	43	.....	.....	.....	.....
100	Nim.	100	Cu. St.	100	St.	se	12	se	8	se	12	57	37	7 a. m.	.....	.....	.....
100	Nim.	100	Cu. St.	100	St.	s w	20	w	24	w	12	37	30	.....	9 a. m.	.10	.....
90	Cu. St.	50	Cu.	100	St.	s w	12	s w	16	w	5	48	33	.....	.....	.....	.....
90	Cu.	40	Cu.	20	Cu.	w	12	w	12	w	9	50	32	.....	In night	.10	½
60	Cu. St.	70	Cu.	00	.....	n e	1	n w	8	....	0	50	31	.....	In night.	.05	.....
100	St.	60	Cu.	20	St.	e	5	s e	6	....	0	57	37	5 a. m.	.....	.....	.....
100	Nim.	90	Cu. St.	10	Cu.	s	4	n w	20	n w	8	59	39	.....	4 p. m.	.30	.....
90	Cu. St.	80	Cu.	00	.....	n w	8	n w	8	w	8	57	32	.....	.....	.....	.....
80	St.	100	St.		Hazy.	w	4	s	4	s	4	62	43	.....	.....	.....	.....
...	.....	...	.....	...	.....	....	....	....	....	....	....	.....	.....	.....	.....	.....	.....
...	.....	...	.....	...	.....	....	....	....	....	....	....	.....	.....	.....	.....	.90	3½
70	.....	64	.....	40	.....	....	....	....	....	....	....	.....	.....	.....	.....	.....	.....
			58														

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Meteorological Observations for the Month of

Day of Month.	Thermometer in Open Air.				Relative Humidity or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	55	72	65	64	87	42	58	.376	.327	.359	29.008	28.927	28.907	28.947
2	67	81	69	72½	64	55	56	.425	.695	.398	28.985	28.967	29.092	28 996
3	55	65	51	57	45	.40	53	.193	.244	.196	29.283	29.291	29.328	29.301
4	53	73	61	62½	61	46	50	.244	.358	.269	29.336	29.265	29.312	29.304
5	52	57	50	53	79	87	65	.308	.407	.234	29.276	29.211	29 112	29.200
6	52	76	61	63	73	47	82	.282	.396	.442	29.085	29.075	29.087	29.082
7	57	79	62	66	87	49	83	.407	.457	.460	29.143	29.120	29.183	29.149
8	66	81	63	70	74	47	89	.470	.565	.510	29.245	29.215	29.248	29.236
9	63	79	65	69	88	46	78	.478	.443	.483	29 275	29.245	29 258	29.259
10	65	78	63	68½	78	43	83	.483	.409	.478	29.283	29.272	29.258	29.271
11	62	84	63	69½	83	37	67	.460	.433	.386	29.283	29.230	29.230	29.248
12	58	94	50	64	58	27	65	.282	.308	.234	29.261	29.190	29.193	29.215
13	66	83	62	70½	59	32	67	.276	.385	.370	29.188	29.170	29.180	29.179
14	62	77	52	63½	40	26	66	.216	.226	.267	29.293	29 285	29.241	29.273
15	60	79	56	65	100	100	63	.500	.958	.282	29.348	29.280	29.233	29.287
16	60	80	60	66½	100	91	55	.500	.931	.283	29.285	29.175	29.130	29.197
17	52	61	55	56	100	94	100	.361	.518	.418	29.188	29.027	29.087	29.101
18	56	68	58	60½	62	37	53	.269	.246	.255	29.091	28.995	29.005	29.030
19	57	78	61	65½	69	53	66	.303	.492	.354	29.201	29.077	28.987	29.068
20	65	84	72	73½	68	43	56	.403	.483	.323	29.191	29.062	29.074	29.109
21	72	86	70	76	75	45	66	.572	.557	.482	29.280	29.205	29.225	29.237
22	68	82	68	72½	74	46	79	.509	.497	.543	29.210	29.145	29.087	29.147
23	64	74	64	67½	94	72	94	.563	.604	.568	29.032	28.950	28.895	28.959
24	62	68	55	61½	88	74	68	.491	.509	.295	28.822	28.738	28.812	28.791
25	52	57	52	53½	79	75	79	.308	.350	.308	28.733	28.808	28.818	28.806
26	47	54	50	50½	85	80	86	.273	.335	.309	28.830	28.850	28.898	28.859
27	50	68	55	57½	86	60	93	.309	.380	.405	28.965	28.978	29.032	28.992
28	57	77	58	64	69	38	82	.322	.336	.394	29.098	29.077	29.050	29.075
29	68	78	67	69½	62	34	55	.336	.278	.362	29.028	28.920	28.867	28.937
30	56	59	56	57	94	88	94	.429	.439	.420	28.787	28.782	28.822	28.797
31	57	69	62	62½	94	65	88	.436	.462	.491	28.958	28.875	28.918	28.917
Sums														
Means				61 °28	76	55	72	.381	.448	.373				29.096
Average						68			.401					

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May, 1887, at Agricultural College, Michigan.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
100	Cu. St.	00	.....	10	St.	s e	8	s	6	s e	8	72	55	.....	.....	.....	.....
100	St.	30	Cu. St.	60	St.	s	8	s w	20	w	12	81	52	.....	.....	.....	.....
70	St.	30	Cu. St.	10	St.	w	12	s w	16	w	8	65	38	.....	.....	.....	.....
15	St.	20	Cir. St.	100	St.	w	2	s w	2	s	8	73	49	.....	.....	.....	.....
100	Nim.	100	Nim.	100	St.	e	8	e	8	n e	4	58	44	7 a. m.	3 p. m.	.10	.....
40	St.	50	Cu.	20	St.	n e	2	s	2	....	0	76	48	.....	.....	.....	.....
20	St.	40	Cu.	00	.....	....	0	e	6	....	0	79	44	.....	.....	.....	.....
00	.....	60	Cu.	10	St.	e	3	e	4	....	0	81	50	3 p. m	4 p. m.	.10	.....
5	St.	50	Cu.	00	.....	....	0	s e	4	....	0	80	53	.....	.....	.....	.....
00	.....	30	Cu.	00	.....	....	0	e	8	....	0	82	55	5 p. m.	6 p. m.	.05	.....
70	Cu. St.	30	Cu.	00	.....	e	1	e	8	....	0	84	47	.....	.....	.....	.....
00	.....	00	.....	00	.....	e	5	e	8	....	0	84	45	.....	.....	.....	.....
00	.....	00	.....	00	.....	n e	2	n e	2	....	0	85	46	.....	.....	.....	.....
00	.....	30	Cu.	00	.....	s e	5	e	6	....	0	78	41	.....	.....	.....	.....
00	.....	Sm	oky.	00	.....	s e	3	n	8	....	0	80	43	.....	.....	.....	.....
Sm	oky.	00	.....	00	.....	n w	3	n	1	....	0	81	51	.....	.....	.....	.....
100	Nim.	100	Nim.	100	Cu. St.	n e	3	s	2	....	0	64	48	3 a. m.	3 p. m.	.45	.....
50	Cu. St.	30	Cu.	00	.....	n e	8	....	0	....	0	70	42	.....	.....	.....	.....
20	Cu.	30	Cu.	10	St.	w	2	s w	4	....	0	78	48	.....	.....	.....	.....
00	.....	00	.....	100	Nim.	s w	3	w	6	....	0	85	61	.....	.....	.....	.....
00	.....	60	Cu. St.	10	St.	s w	2	s	8	w	1	88	55	.....	.....	.....	.....
10	Cu. Cir.	10	Cu.	00	.....	s w	4	s w	8	....	0	83	61	.....	.....	.....	.....
50	Nim.	80	Cu. St.	100	Nim.	s e	1	s w	12	s	1	77	58	6 a. m.	.....	.....	.....
90	St.	50	Cu. St.	00	.....	w	4	s w	16	....	0	75	45	.....	4 p. m.	.50	.....
00	.....	100	Cu. St.	70	Cu. St.	s w	8	n w	8	w	1	63	42	.....	.....	.....	.....
100	Cu. St.	100	Nim.	00	.....	n w	12	n w	8	....	0	58	45	.....	.....	.....	.....
100	Cu. St.	70	Cu.	00	.....	n w	1	n w	8	w	1	70	45	.....	.....	.....	.....
00	.....	10	Cir.	00	.....	n	2	n e	3	....	0	78	46	.....	.....	.....	.....
00	.....	20	Cu. St.	00	.....	....	0	s	8	s	4	80	54	.....	.....	.....	.....
100	Nim.	100	Cu. St.	30	St.	s w	2	s e	5	....	0	60	53	4 a. m.	4 p. m.	.40	.....
100	Cu. St.	100	Cu. St.	100	St.	s	8	s e	12	s e	5	79	55	4 p. m.	12 m.	.82	.....
....	.....	....	.....	....	.....	....	....	....	....	....	....	.....	.....	.....	.....	2 42	.....
41	.....	41	.....	27	.....	....	....	....	....	....	....	.....	.....	.....	.....	.....	.....
				86													

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Meteorological Observations for the Month of

Day of Month.	Thermometer in open air.				Relative Humidity, or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	59	63	59	60½	94	83	88	.469	.478	.439	28.935	28.937	28.957	28.936
2	54	57	57	56	100	94	100	.418	.436	.466	28.858	28.862	28.935	28.885
3	58	74	60	64	94	55	88	.452	.463	.456	28.990	29.007	29.017	29.005
4	65	80	73	72½	84	55	81	.516	.561	.655	29.062	29.072	29.052	29.069
5	70	78	67	71	90	82	100	.658	.731	.662	29.107	29.087	29.082	29.092
6	67	78	68	71	100	73	95	.662	.704	.648	29.087	29.053	29.072	29.070
7	68	79	69	72	95	70	95	.648	.691	.671	29.122	29.117	29.077	29.105
8	70	83	72	75	90	60	80	.658	.677	.631	29.075	28.952	28.947	28.991
9	67	66	58	63½	89	79	88	.591	.502	.423	28.957	29.015	29.070	29.014
10	56	74	58	62½	100	47	82	.449	.396	.394	29.115	29.165	29.193	29.158
11	61	77	60	66	83	46	71	.442	.423	.367	29.311	29.305	29.271	29.296
12	65	77	65	69	68	46	73	.389	.423	.451	29.304	29.243	29.215	29.254
13	68	82	65	70	78	48	84	.446	.510	.516	29.241	29.207	29.210	29.219
14	68	82	71	73½	79	56	85	.543	.585	.644	29.255	29.244	29.205	29.235
15	67	79	70	72	95	62	85	.626	.610	.621	29.238	29.173	29.107	29.173
16	72	85	71	76	76	68	80	.595	.819	.608	29.050	29.002	28.992	29.015
17	73	88	67	76	76	53	95	.617	.602	.626	28.990	28.846	28.897	28.911
18	66	84	68	72½	95	47	90	.604	.545	.612	28.930	28.892	28.907	28.910
19	73	83	68	74	71	52	79	.559	.573	.543	28.897	28.917	28.967	28.927
20	67	82	67	72	79	49	95	.522	.460	.626	29.040	28.997	28 912	28.988
21	64	73	58	65	88	42	76	.497	.327	.365	28.887	28.915	28.937	28.913
22	60	65	60	61½	77	63	55	.396	.389	.288	28.845	28.770	28.830	28.815
23	55	57	53	55	81	69	54	.349	.322	.295	28.880	28.898	28.995	28.918
24	53	67	58	59	86	42	88	.334	.274	.423	29.058	29.062	29.092	29.077
25	65	79	60	68	54	33	71	.346	.329	.367	29.250	29.250	29.331	29.277
26	60	76	60	65½	65	38	71	.333	.369	.367	29.486	29.485	29.451	29.474
27	60	81	65	68½	77	37	58	.396	.382	.359	29.526	29.455	29.445	29.475
28	60	85	71	72	77	31	58	.396	.363	.436	29.463	29.389	29.395	29.416
29	65	89	74	76	78	33	55	.483	.440	.453	29.395	29.331	29.308	29.343
30	72	84	71	75½	67	50	85	.524	.584	.644	29.308	29.257	29.240	29.268
31														
Sums														
Means				68°.53	83	55	80	.497	.503	.502				29.107
Averages						73			.500					

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June, 1887, at Agricultural College, Michigan.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning Rain or Snow.	Ending Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
100	Nim.	100	Cu. St.	100	St.	s e	3	e	4	e	3	63	54	.....	.....	.....	.....
100	Nim.	100	Nim.	100	St.	n	8	n e	6	n w	4	58	54	4 a. m.	6 p. m.	.66	.....
70	Cu. St.	50	Cu.	00	.....	w	6	w	12	....	0	75	52	.....	.....	.....	.....
60	St.	60	Cu. St.	100	Nim.	w	1	s	3	....	0	83	63	8 p. m.	10 p. m.	.15	.....
100	St.	100	St.	100	Nim.	s e	1	s	4	s e	2	76	66	7 p. m.	.....	.33	.....
100	Nim.	80	Cu. St.	10	St.	....	0	n	5	....	0	79	63	.....	5 p. m.	.10	.....
100	St.	30	Cu.	00	.....	n e	1	n	1	n e	1	80	62	.....	.....	.....	.....
10	St.	50	Cu.	100	St.	s w	1	s w	1	s w	1	84	66	.....	.....	.....	.....
100	St.	100	Cu. St.	00	.....	n	1	n	7	n e	1	69	48	.....	.....	.....	.....
20	St.	20	Cu.	00	.....	n e	4	n e	6	n	1	74	45	.....	.....	.....	.....
20	St.	20	Cir. St.	00	.....	e	3	s e	12	....	0	77	54	.....	.....	.....	.....
70	Cir. St	30	Cir. St.	00	.....	s	7	s	5	s e	3	79	53	.....	.....	.....	.....
20	Cir.	40	Cu. St	00	.....	s	2	n w	3	....	0	83	59	.....	.....	.....	.....
60	Cir.Cu.	60	Cu. St.	100	St.	n e	2	e	1	....	0	84	65	.....	.....	.....	.....
100	Nim.	90	Cu. St.	00	.....	....	0	e	4	....	0	80	64	6 a. m.	7 a. m.	.05	.....
00	.....	70	Cu.	00	.....	s	7	n w	8	....	0	85	61	.....	.....	.....	.....
40	Cir.Cu.	50	Cu.	100	Nim.	s w	5	s w	12	n w	5	88	61	7 p. m.	10 p. m.	1.05	.....
100	St.	10	Cu.	10	St.	n e	2	n w	12	....	0	84	64	.....	.....	.....	.....
10	St.	20	Cu.	00	.....	s w	8	s w	9	....	0	84	53	.....	.....	.....	.....
10	St.	50	Cir. St.	20	St.	s	4	s e	4	s w	6	85	63	.....	.....	.....	.....
100	Cu. St.	5	Cu.	10	St.	w	8	w	16	....	0	73	52	.....	At night	.05	.....
30	Cir.	80	Cu. St.	90	Cu. St.	s w	8	s w	16	w	2	72	52	.....	.....	.....	.....
80	Cu.	100	Cu St.	100	St.	w	8	w	7	w	2	58	48	.....	.....	.....	.....
50	Cu. St.	80	Cu.	50	St.	s w	8	w	6	....	0	69	43	.....	.....	.....	.....
20	Cu.	50	Cu.	00	.....	w	8	n w	3	e	1	81	45	.....	.....	.....	.....
00	.....	10	Cu.	00	.....	e	3	n e	3	....	0	77	45	.....	.....	.....	.....
10	Cir.	10	Cir.	00	.....	e	2	e	4	....	0	81	48	.....	.....	.....	.....
10	Cir.	20	Cir. St.	10	St.	s e	1	s e	3	....	0	86	51	.....	.....	.....	.....
10	Cir.	20	Cir.	00	.....	s e	2	s e	4	....	0	91	61	.....	.....	.....	.....
00	Cir. St	100	Cu. St.	20	Cir.	s e	4	s w	3	....	0	90	65	3 p. m.	4 p. m.	.08	.....
....	.....	....	.....	....	.....	....	....	....	....	....	....	.....	.....	.....	.....	.....	.....
....	.....	....	.....	....	.....	....	....	....	....	....	....	.....	.....	.....	.....	2.47	.....
52	.....	54	.....	34	.....	....	....	....	....	....	....	.....	.....	.....	.....	.....	.....
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Meteorological Observations for the Month of

Day of Month.	Thermbmeter in Open Air.				Relative Humidity, or Per Cent. of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	76	85	75	78⅝	69	51	77	.614	.610	.666	29.212	29.159	29.107	29.159
2	76	81	67	74⅝	73	70	100	.652	.745	.662	29.130	29.072	29.097	29.099
3	78	79	73	76⅝	73	58	81	.704	.574	.655	29.102	29.012	29.017	29.043
4	71	71	70	70⅝	90	90	95	.682	.682	.695	28.995	28.965	28.977	28.979
5	70	78	67	71⅝	85	65	89	.621	.626	.591	28.997	28.982	29.030	29.003
6	68	85	71	74⅝	84	44	75	.577	.531	.572	29.075	29.064	29 074	29.071
7	69	86	77	77½	80	48	69	.564	.596	.639	29.092	29.036	29.047	29.058
8	73	92	78	81	72	45	61	.581	.680	.588	29.042	28.989	28.932	28.987
9	75	81	68	74⅝	72	55	65	.628	.585	.443	28.817	28.797	28.897	28.833
10	72	84	70	75½	67	40	61	.524	.470	.449	29.030	29.054	29.077	29.053
11	64	89	72	75	78	30	54	.464	.401	.422	29.133	29.121	29.112	29.122
12	74	92	79	81⅝	55	34	58	.463	.515	.574	29.158	29.146	29.117	29.140
13	72	87	77	78⅝	95	58	77	.745	.748	.717	29.159	29.181	29.159	29.166
14	68	88	76	77½	70	40	60	.476	.530	.541	29.302	29.251	29.214	29 255
15	73	97	79	83	72	28	78	.581	.488	.772	29.178	29.215	29.181	29.173
16	80	94	81	85	66	41	70	.677	.653	.745	29.119	29.081	29.091	29.097
17	86	94	77	85⅝	55	36	77	.677	.569	.717	29.074	29.068	29.101	29 081
18	67	66	65	66	84	95	94	.556	.604	.583	29.164	29.178	29.178	29.173
19	62	82	67	70½	83	46	74	.460	.497	.489	29.193	29.192	29 178	29.187
20	67	87	71	75	89	39	71	.591	.504	.537	29.170	29.122	29.074	29.122
21	66	77	73	72	95	73	90	.604	.678	.732	29.090	29.024	28.947	29.020
22	69	84	65	72⅝	95	47	68	.671	.545	.420	28.907	28.907	29.050	28.954
23	55	72	56	61	62	42	81	.269	.327	.363	29.205	29.215	29.241	29.220
24	62	79	66	69	67	47	69	.370	.465	.438	29.266	29.228	29.225	29.259
25	64	85	65	71½	73	32	63	.433	.384	.389	29.238	29.250	29.220	29.234
26	65	88	66	72⅝	73	26	68	.451	.344	.420	29.251	29.179	29.178	29.202
27	71	90	74	78½	71	33	68	.537	.464	.568	29.150	29.091	29.077	29.106
28	69	88	69	75½	80	40	80	.564	.530	.564	29.084	29.102	29.150	29.112
29	65	92	78	78½	89	34	54	.549	.515	.514	29.185	29.054	29.114	29.117
30	73	91	76	80	72	42	69	.581	.610	.614	29 074	29.076	29.092	29.080
31	71	88	72	77	62	29	54	.469	.380	.422	29.160	29.087	29.083	29.109
Sums														
Means				75.°51	76	47	73	.559	.544	.565				29.104
Average						65			.556					

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July, 1887, at Agricultural College, Michigan.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning Rain or Snow.	Ending Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
10	Cir.	70	Cu. St.	80	St.	s w	8	s w	8	s w	3	87	68	.....	.....	.....	.....
30	Cir.Cu.	90	Cu. St.	100	Nim.	s w	12	n	4	w	3	88	66	7 p. m.	12 m.	.20	.....
80	Cu. St.	100	Cu. St.	90	St.	s	6	s w	12	s	8	88	68	.....	.....	.....	.....
100	St.	100	Nim.	100	St.	s	12	s w	12	s	1	80	68	1 p. m.	7 p. m.	.21	.....
90	St.	60	Cu. St.	00	.....	s w	8	s w	12	....	0	80	59	.....	.....	.....	.....
30	Cu.	30	Cu.	00	.....	w	4	n w	8	....	0	87	58	.....	.....	.....	.....
20	Cu.	50	Cu.	00	.....	n	4	w	6	....	0	90	62	.....	.....	.....	.....
00	.....	10	Cu.	00	.....	w	4	w	6	....	0	93	68	.....	.....	.....	.....
80	Cu. St.	50	Cu.	10	St.	s w	8	w	12	n	6	84	56	.....	.....	.....	.....
00	.....	30	Cu.	00	.....	n w	8	n w	8	w	2	86	58	.....	.....	.....	.....
00	.....	00	.....	00	.....	w	1	s w	4	....	0	92	56	.....	.....	.....	.....
00	.....	30	Cir. St.	00	.....	s w	6	s w	5	s w	4	94	69	.....	.....	.....	.....
70	Cu. St.	90	Cu. St.	00	.....	n	3	n	3	....	0	89	62	2 a. m.	5 a. m.	.45	.....
10	Cu. St.	70	Cir. St.	10	St.	e	2	e	2	s e	6	89	67	.....	.....	.....	.....
30	Cir.	50	Cu. St.	00	.....	s e	6	s w	8	....	0	98	73	.....	.....	.....	.....
30	Cu. St.	30	Cu.	10	St.	s w	8	w	8	w	4	96	76	.....	.....	.....	.....
10	Cu.	90	Cu. St.	10	St.	w	4	w	8	n	3	98	67	.....	.....	.....	.....
100	Cu. St.	100	Nim.	50	St.	e	2	n	8	n e	1	68	56	12 m.	1 p. m.	.02	.....
00	.....	10	Cir.	00	.....	n	3	n e	2	....	0	83	56	.....	.....	.....	.....
30	Cir.	30	Cir.	40	St.	s w	1	n e	1	....	0	91	66	.....	.....	.....	.....
100	Nim.	90	Cu. St.	90	St.	w	1	s	4	....	0	79	66	2 a. m.	10 a. m.	.62	.....
100	Cu. St.	70	Cu. St.	100	St.	w	6	w	6	n	6	85	49	.....	.....	.....	.....
00	.....	00	.....	00	.....	n	1	n	4	....	0	75	44	.....	.....	.....	.....
00	.....	10	Cir.Cu.	00	.....	n	2	n e	2	n e	2	80	54	.....	.....	.....	.....
30	St.	00	.....	00	.....	n e	2	n e	4	....	0	86	57	.....	.....	.....	.....
00	.....	00	.....	00	.....	n	1	e	2	....	0	90	64	.....	.....	.....	.....
10	Cu.	50	Cu. St.	00	.....	s	2	s w	1	....	0	94	68	.....	.....	.....	.....
Sm	oky.	20	Cu.	Sm	oky.	n	4	s e	0	....	0	88	59	.....	.....	.....	.....
90	Cu. St.	10	Cu.	00	.....	n	6	w	7	s	1	92	65	.....	.....	.....	.....
80	Cu.	60	Cu.	20	Cir.	s	2	w	2	w	7	92	60	.....	.....	.....	.....
00	.....	10	Cir.	30	Cir. St.	n e	8	n	8	n	4	91	60	.....	.....	.....	.....
....	.....	....	.....	....	.....	....	....	....	....	....	....	.....	.....	.....	.....	1.50	.....
38	.....	45	.....	23	.....	....	....	....	....	....	....	.....	.....	.....	.....	.....	.....
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Meteorological Observations for the Month of

Day of Month.	Thermometer in Open Air.				Relative Humidity or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	67	89	65	73⅗	64	24	73	.425	.331	.451	29.082	29.059	29.087	29.076
2	64	95	79	79½	73	28	54	.433	.449	.537	29.112	29.106	29.119	29 112
3	70	93	77	80	75	32	60	.551	.502	.639	29.152	29.138	29.129	29.140
4	74	84	72	76⅗	55	44	76	.463	.507	.595	29.120	29.076	29.024	29.073
5	75	92	69	78⅗	81	36	75	.705	.529	.529	29.012	28.979	29.059	29.017
6	63	79	60	67½	67	30	65	.366	.296	.338	29.178	29.084	29.190	29.151
7	66	83	70	73	59	27	48	.376	.308	.353	29.261	29.217	29.238	29.237
8	63	88	73	74⅗	67	23	39	.446	.309	.313	29.291	29.241	29.228	29.253
9	66	91	76	77½	78	48	49	.488	.694	.436	29.230	29.192	29.164	29.202
10	72	96	82	83	76	29	49	.595	.475	.534	29.135	29.058	28.949	29.047
11	70	77	71	72⅗	90	86	90	.656	.799	.682	28.972	28 992	29.042	29.002
12	62	77	62	67	72	69	72	.399	.291	.399	29.205	29.208	29.205	29.206
13	57	74	64	65	81	43	73	.378	.363	.433	29.211	29.165	29.145	29.174
14	60	70	63	64½	88	66	94	.456	.422	.543	29.112	29.042	29.003	29.052
15	63	66	65	64⅗	94	100	84	.543	.618	.516	28.962	28.962	29.012	28.975
16	61	76	65	67½	88	52	78	.473	.470	.483	29.045	29.035	29.027	29.036
17	63	67	58	62⅗	72	84	100	.416	.556	.483	29.018	28.942	28.905	28.955
18	59	83	70	70⅗	100	43	53	.500	.483	.403	28.938	28.912	28.985	28.945
19	56	77	60	64½	69	37	70	.308	.318	.352	29.068	28 974	28.892	29.018
20	58	78	63	66½	82	43	83	.394	.409	.478	29.098	29.052	29.027	29.059
21	64	72	67	69⅗	89	71	89	.529	.559	.591	29.013	29.007	28.947	28.989
22	65	78	64	69	94	57	83	.583	.550	.497	28.922	28.852	28.877	28.884
23	58	58	56	57½	94	88	94	.459	.423	.420	28.983	28.960	29.000	28.964
24	55	67	58	60	87	42	76	.376	.274	.365	29.045	29.075	29.115	29.078
25	50	70	53	57⅗	79	36	80	.283	.263	.321	29.246	29.216	29.238	29.233
26	49	62	54	55	93	56	80	.322	.312	.335	29.252	29.246	29.231	29.243
27	47	70	50	59	92	36	86	.298	.263	.309	29.244	29.246	29.246	29.245
28	56	70	55	60½	63	28	68	.282	.206	.295	29.299	29.256	29.286	29.280
29	48	79	57	61½	78	27	63	.260	.264	.295	29.342	29.316	29.333	29.330
30	51	81	64	65½	79	23	48	.296	.238	.335	29.336	29.340	29.331	29.352
31	56	84	66	68⅗	87	22	45	.391	.262	.287	29.376	29.314	29.271	29.320
Sums														
Means				67°.96	80	46	71	.434	.413	.435				29.117
Average						66			.427					

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August, 1887, at Agricultural College, Michigan.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow. Inches.
20	Cir.Cu.	40	Cir.Cu.	Sm	oky.	n	2	n e	4	....	0	91	56	.....	.....	.....	.....
Sm	oky.	20	Cir.Cu.	Sm	oky.	n	2	w	8	w	2	96	62	.....	.....	.....	.....
Sm	oky.	60	Cu. St.	90	Cu. St.	w	1	w	4	....	0	98	68	.....	.....	.....	.....
80	Cir.Cu.	100	St.	00	.....	s w	8	w	2	....	0	90	67	.....	.....	.....	.....
00	.....	100	Cu. St.	Sm	oky.	s w	6	w	12	n	3	96	62	.....	.....	.....	.....
Sm	oky.	10	Cu.	00	.....	n	4	n	6	....	0	81	52	.....	.....	.....	.....
00	.....	10	Cu.	00	.....	s e	6	s e	5	s e	6	86	57	.....	.....	.....	.....
10	Cu.	10	Cir.	10	Cir.	s e	8	s e	8	s e	6	89	60	.....	.....	.....	.....
100	St.	60	Cir. St.	100	St.	s e	4	s w	8	....	0	91	65	.....	.....	.....	.....
90	St.	60	Cir. St.	90	Cu. St.	....	0	s w	8	s w	4	95	67	11 p. m.	.....	.....	.....
100	Cu. St.	80	Cu. St.	00	.....	s w	6	w	6	....	0	77	56	.....	2 a. m.	.40	.....
10	St.	60	Cir.Cu.	00	.....	n	5	n	8	....	0	77	49	.....	.....	.....	.....
20	Cir.Cu.	100	Nim.	100	St.	....	0	n e	2	....	0	78	56	.....	.....	.....	.....
100	Nim.	100	Nim.	80	St.	s e	2	s e	7	s e	1	72	59	.....	.....	.....	.....
100	Nim.	100	Nim.	100	St.	s e	2	e	1	n e	2	67	55	7 a. m.	6 p. m.	.24	.....
80	St.	50	Cu.	00	.....	n e	5	n	2	....	0	78	59	.....	.....	.....	.....
100	St.	100	St.	00	.....	n e	1	e	2	....	0	67	50	.....	.....	.....	.....
100	St.	70	Cu. St.	50	Cu. St.	s e	1	s w	12	w	5	88	45	.....	.....	.....	.....
00	.....	00	.....	00	.....	n	2	n	8	....	0	78	55	.....	.....	.....	.....
100	St.	90	Cu. St.	00	.....	n w	1	w	4	....	0	82	56	.....	.....	.....	.....
100	Nim.	90	Cu. St.	20	St.	n	3	s w	8	....	0	72	60	3 a. m.	3 p. m.	.12	.....
100	Fog.	60	Cu.	100	St.	....	0	w	8	n e	2	79	56	Showers.		.08	.....
100	Cu. St.	100	St.	100	St.	....	0	n e	5	n	1	59	55	Showers.		.05	.....
50	Cu.	50	Cu.	90	Cu.	n	5	n	12	n	2	69	40	.....	.....	.....	.....
10	St.	50	Cu.	20	St.	n	2	n e	4	n e	1	70	45	.....	.....	.....	.....
100	St.	80	Cu. St.	00	.....	n	1	n e	1	....	0	64	40	.....	.....	.....	.....
100	St.	50	Cu.	00	.....	e	1	n	3	....	0	72	39	.....	.....	.....	.....
40	Cu.	30	Cu.	10	St.	n	1	n	1	n e	1	74	37	.....	.....	.....	.....
Sm	oky.	00	.....	00	.....	n e	1	e	1	....	0	79	40	.....	.....	.....	.....
00	.....	10	Cu.	00	.....	....	0	s e	1	....	0	81	47	.....	.....	.....	.....
00	.....	10	Cir.	00	.....	s e	1	s	1	s	1	83	56	.....	.....	.....	.....
----	.....	----	.....	----	.....	----	----	----	----	----	----	-----	-----	-----	-----	.89	.....
56	.....	56	.....	32	.....	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----
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Meteorological Observations for the Month of

Day of Month.	Thermometer in Open Air.				Relative Humidity, or Per Cent. of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1.	65	70	65	66⅔	100	75	100	.301	.551	.618	29.226	29.161	29.125	29.171
2.	65	68	60	61⅓	100	84	94	.618	.577	.487	29.087	29.122	29.151	29.120
3.	53	71	59	61⅓	93	49	82	.405	.371	.410	29.238	29.293	29.281	29.261
4.	63	82	66	70⅓	78	23	36	.446	.256	.231	29.359	29.338	29.321	29.329
5.	62	85	71	72⅔	72	41	80	.399	.493	.608	29.284	29.189	29.128	29.200
6.	69	70	69	69⅓	85	95	90	.626	.695	.635	28.962	28 897	28.792	28.884
7.	63	66	53	60⅔	78	50	73	.446	.316	.295	28.842	28.862	29.028	28.911
8.	45	66	54	55	93	54	80	.275	.330	.335	29.190	29.176	29.118	29.164
9.	52	67	53	57⅓	100	64	86	.388	.425	.348	29.051	28.953	29.156	29.053
10.	44	61	50	51⅔	84	59	79	.241	.296	.283	29.494	29.436	29.426	29.429
11.	56	65	57	59⅓	63	68	94	.282	.403	.436	29.374	29.246	29.218	29.279
12.	53	66	62	56⅔	100	79	100	.358	.502	.556	29.204	29.146	29.048	29.133
13.	74	81	62	72⅓	76	59	77	.641	.624	.429	28.925	28.957	29.107	29.996
14.	54	74	55	60⅓	93	35	74	.375	.283	.341	29.286	29.328	29.276	29.247
15.	51	68	50	56⅓	79	59	65	.296	.376	.234	29.311	29.323	29.403	29.346
16.	41	68	46	50	82	55	92	.212	.283	.286	29.539	29.581	29.481	29.517
17.	45	71	58	58⅓	92	51	80	.275	.349	.321	29.451	29.383	29.358	29.397
18.	49	74	54	59	64	36	93	.348	.423	.375	29.386	29.345	29.358	29.363
19.	49	75	58	60⅔	93	44	76	.322	.382	.365	29 463	29.435	29.453	29.450
20.	48	81	67	65⅓	93	42	74	.310	.428	.489	29.473	29.373	29.288	29.378
21.	66	77	66	69⅔	78	65	95	.483	.601	.604	29.185	29.117	29.102	29.135
22.	51	63	50	54⅔	100	56	65	.374	.312	.234	29.112	29.065	29.107	29.095
23.	42	50	34	42	74	45	90	.199	.163	.175	29.227	29.268	29.297	29.269
24.	31	52	42	41⅔	89	47	88	.155	.241	.222	29.336	29.293	29.268	29.299
25.	46	57	43	48⅓	77	53	83	.238	.244	.231	29.222	29.210	29.206	29.313
26.	44	60	53	54	84	55	80	.241	.283	.321	29.170	29.143	29 102	29.138
27.	50	58	54	54	100	70	80	.348	.337	.335	29.071	29.052	29.117	29.080
28.	48	68	54	56⅔	85	42	74	.285	.274	.308	29.132	29.087	29.087	29.102
29.	54	65	54	57⅔	93	78	100	.390	.483	.418	29.100	29.077	29.067	29.081
30.	58	62	55	58⅓	94	77	93	.452	.429	.405	28.985	28.963	28.932	28.960
31.														
Sums.														
Means.				58.°86	86	57	82	.358	.385	.377				29.260
Average.						75			.373					

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September, 1887, at Agricultural College, Michigan.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow. Inches.
100	Cu. St.	100	Cu. St.	100	Nim.	s w	4	s w	7	s w	3	72	63	7 p. m.	.....	.....	.....
100	Nim.	100	Nim.	10	Cir.	w	2	w	5	n e	2	68	46	.....	3 p. m.	.65	.....
00	.....	10	Cu.	00	.....	n e	3	n e	3	e	1	73	47	.....	.....	.....	.....
00	.....	00	.....	00	.....	s e	5	s	6	....	0	82	57	.....	.....	.....	.....
00	.....	100	Cu St.	100	Nim.	s	6	s w	3	s w	3	88	62	7 p. m.	.....	.....	.....
70	Cu. St.	100	Nim.	20	St.	s w	12	s w	12	s w	7	72	60	.....	7 p. m.	1.50	.....
90	Cu. St.	40	Cu.	00	.....	w	20	n w	4	n	3	69	40	.....	.....	.....	.....
00	.....	30	Cu.	30	St.	n	3	n w	4	n	3	66	52	.....	.....	.....	.....
100	Nim.	100	Nim.	00	.....	s	4	s w	4	n	3	67	37	2 a. m.	6 p. m.	1.32	.....
80	Cu. St.	60	Cu. St.	70	St.	n	4	n e	6	n e	3	61	44	.....	.....	.....	.....
30	Cir.Cu.	100	Cu. St.	00	.....	s e	4	e	4	e	0	65	48	.....	.....	.....	.....
100	Fog.	100	Cu. St.	100	Nim.	s e	2	s e	2	s e	3	73	52	6 p. m.	10 p. m.	.63	.....
10	St.	100	Cu. St.	10	St.	s w	12	w	12	....	0	85	48	.....	.....	.....	.....
20	St.	20	Cir.	00	.....	w	4	n w	12	....	0	74	48	.....	.....	.....	.....
80	St.	70	Cu. St.	00	.....	w	3	n w	3	n	4	69	36	.....	.....	.....	.....
00	.....	00	.....	00	.....	n	3	n e	2	....	0	63	38	.....	.....	.....	.....
00	.....	00	St.	00	.....	e	2	s e	4	....	0	71	37	.....	.....	.....	.....
Fog.	.....	60	.....	00	.....	....	0	w	2	....	0	76	44	.....	.....	.....	.....
00	.....	00	.....	00	.....	....	0	n e	2	n e	1	77	45	.....	.....	.....	.....
90	St.	40	Cir. St.	30	St.	....	0	s w	4	s w	3	81	48	.....	.....	.....	.....
90	Cu. St.	100	Cu. St.	100	Nim.	s w	3	s w	12	s w	2	80	49	6 p. m.	.....	.....	.....
100	Nim.	30	Cu. St.	100	Nim.	n e	1	n	6	n e	5	63	37	.....	8 a. m.	.31	.....
00	.....	30	Cum.	00	.....	n e	3	n	3	n	1	54	26	.....	.....	.....	.....
00	.....	75	Cu. St.	100	Cu. St.	n	1	s e	2	s e	1	56	31	.....	.....	.....	.....
90	Cu. St.	40	Cu.	00	.....	s e	1	s e	2	....	0	62	32	.....	.....	.....	.....
00	.....	100	Cu. St.	100	Nim.	....	0	s	2	s	1	60	43	7 p. m.	8 p. m.	.01	.....
100	Nim.	100	Cu. St.	100	Cu. St.	s e	1	e	4	e	3	58	44	.....	.....	.....	.....
00	.....	00	.....	100	St.	n e	5	n e	3	n	3	68	47	.....	.....	.....	.....
Fog.	.....	90	Cu. St.	....	Fog.	n e	1	e	2	....	0	65	53	4 a. m.	.....	.....	.....
100	Nim.	60	Cu. St.	100	Nim.	....	0	s w	3	s	5	63	50	.....	10 p. m.	.30	.....
....	.....	....	.....	....	.....	....	....	....	....	....	....	.....	.....	.....	.....	.....	.....
....	.....	....	.....	....	.....	....	....	....	....	....	....	.....	.....	.....	.....	4.72	.....
48	.....	57	.....	40	.....	....	....	....	....	....	....	.....	.....	.....	.....	.....	.....
			48														

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Meteorological Observations for the Month of

Day of Month.	Thermometer, in open air.				Relative Humidity, or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M	Mean.
1	54	55	53	54	61	93	100	.256	.405	.403	28.945	28.905	28.935	28.928
2	54	63	59	58⅝	93	72	82	.390	.416	.410	28.990	28.942	28.768	28.900
3	53	62	54	56½	67	72	61	.239	.399	.256	28.673	28.718	28.760	28.717
4	46	47	43	45½	69	70	83	.210	.225	.231	28.733	28.767	28.867	28.789
5	41	45	43	43	91	68	92	.225	.204	.254	28.968	28.992	28.997	28.986
6	45	57	48	50	92	69	100	.275	.322	.333	28.918	28.898	29.012	28.943
7	53	73	64	63½	86	67	89	.348	.545	.529	29.085	29.065	29.102	29.084
8	65	72	66	67⅜	78	54	69	.464	.422	.438	29.213	29.120	29.098	29.144
9	60	65	65	63⅓	100	94	94	.518	.583	.583	28.938	28.897	28.987	28.941
10	47	50	45	47⅓	85	78	76	.273	.272	.228	29.096	29.196	29.238	29.177
11	41	46	38	41⅝	91	54	91	.235	.169	.208	29.166	29.105	29.206	29.159
12	37	50	46	44⅓	90	44	54	.199	.152	.169	29.199	29.166	28.938	29.101
13	43	54	38	45	75	48	72	.209	.194	.165	28.958	29.048	29.194	29.067
14	37	50	35	40⅝	81	57	80	.178	.199	.152	29.251	29.304	29.364	29.306
15	32	56	41	44	100	39	68	.181	.168	.196	29.381	29.314	29.275	29.328
16	42	65	52	53	58	40	66	.155	.244	.257	29.222	29.118	29.073	29.137
17	55	65	47	55⅝	68	54	85	.295	.330	.373	28.967	29.063	29.102	29.057
18	36	56	36	42⅝	90	45	90	.191	.193	.191	29.193	29.112	29.060	29.088
19	29	59	43	43⅝	.....	32	75	.125	.153	.209	29.023	29.010	28.928	28.987
20	41	55	42	46	65	56	91	.169	.243	.244	28 835	28.743	28 840	28.806
21	35	36	34	35	80	71	79	.162	.149	.155	28.857	28.878	29.020	28.918
22	32	46	37	38⅓	79	40	71	.143	.125	.157	29.151	29.141	29.165	29.153
23	40	48	41	43	100	93	74	.238	.310	.190	28.892	28.545	28.705	28.714
24	34	41	33	35⅝	70	56	69	.138	.139	.125	29.307	29.304	29.398	29.303
25	22	34	21	25⅝	86	79	100	.101	.155	.113	29.487	29.521	29.540	29.516
26	14	40	30	28	100	82	78	.082	.203	.180	29.517	29.418	29.404	29.446
27	28	46	30	34⅝	88	40	100	.135	.125	.167	29.432	29.433	29.441	29.435
28	37	53	44	44⅝	100	67	84	.221	.269	.241	29.366	29.191	29.125	29.227
29	38	29	27	31⅓	81	78	76	.186	.123	.111	29.171	29.325	29.444	29.313
30	24	37	34	31⅗	87	38	100	.111	.084	.196	29.416	29.296	29.250	29.321
31	33	54	34	40⅓	70	48	100	.131	.194	.196	29.169	29.145	29.233	29.179
Sums	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Means	.....	.....	.....	44°.97	83	61	82	.220	.248	.242	.....	.....	.....	29.108
Averages						75			.237					

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October, 1887, at Agricultural College, Michigan.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow. Inches.
100	Cu. St.	100	Nim.	100	Nim.	s w	8	s w	6	s w	5	56	51	8 a. m.	10 p. m.	.33	.....
100	Cu. St.	80	Cu. St.	100	Cu. St.	s w	3	s w	5	s	8	63	50	.....	.....	.....	.....
100	Cu. St.	30	Cu.	100	St.	w	16	w	24	w	8	62	45	.....	.....	.....	.....
100	Cu. St.	100	Cu. St.	100	Cu. St.	n w	4	n w	12	n w	8	47	40	3 p. m.	5 p. m.	.05	.....
100	Cu. St.	100	Cu. St	60	St.	n w	8	w	6	s w	6	45	40	.....	.....	.....	.....
100	Cu. St	100	Cu. St.	60	St.	s	8	s w	12	....	0	58	44	12 m.	2 a. m.	.11	.....
70	Cu. St.	30	Clr.	20	St.	n e	1	s e	4	....	0	73	50	.....	.....	.....	.....
100	Cu. St.	100	Cu. St.	100	St.	s w	1	s w	2	s w	1	72	60	.....	.....	.....	.....
100	Nim.	100	Nim.	100	Nim.	s	4	s w	6	w	6	65	45	5 a. m.	.....	.....	.....
100	Nim.	100	St.	50	St.	n	5	n w	4	n	3	50	35	.....	8 a. m.	.28	.....
100	Nim.	60	Cu. St.	10	St.	n w	2	n w	4	....	0	51	35	4 a. m.	11 a. m.	.10	.....
100	St.	30	Cu.	90	St.	n w	3	s w	5	s w	3	50	37	.....	.....	.....	.....
00	.....	30	Cu.	....	.....	w	6	n w	5	....	....	54	31	.....	.....	.....	.....
00	.....	50	Cu.	....	.....	n w	3	n w	4	....	....	53	23	.....	.....	.....	.....
00	.....	00	.....	00	.....	s	6	s	6	s	6	57	32	.....	.....	.....	.....
70	Cu.	40	Cu. St.	00	.....	s	8	s	12	....	....	66	40	.....	.....	.....	.....
100	Cu. St.	70	Cu.	50	Cu. St.	s	12	s w	12	w	8	65	29	3 p. m.	4 p. m.	.01	.....
10	St.	00	.....	00	.....	n w	5	s w	2	w	1	57	24	.....	.....	.....	.....
100	Fog.	5	Cu.	00	.....	s w	3	s	8	e	8	59	27	.....	.....	.....	.....
5	Cu. St.	90	Nim.	100	Nim.	s e	6	s e	12	w	12	60	33	12 m.	12 p. m.	.18	.12
70	Nim.	70	Cu.	100	Cu.	w	8	w	20	w	8	38	24	.....	.....	.....	Snow.
00	.....	20	Cu. St.	100	St.	w	4	w	6	e	8	48	31	.....	.....	.....	.....
100	Nim.	100	Nim.	100	St.	e	12	n w	16	w	16	53	32	4 a. m.	5 p. m.	.80	.....
70	Cu. St.	90	Cu. St.	20	St.	w	8	n w	12	n w	16	45	20	.....	.....	.....	.....
20	St.	10	Cu.	10	St.	w	8	n w	12	....	0	34	12	.....	.....	.....	.....
30	St.	00	.....	00	.....	e	0	s w	6	....	0	40	14	.....	.....	.....	.....
00	.....	80	Clr.Cu.	20	St.	s w	3	w	4	....	0	50	28	.....	.....	.....	.....
70	St.	100	St.	100	St.	s w	6	s w	8	s w	5	54	36	.....	.....	.....	.....
100	Nim.	100	Cu. St.	80	St.	n	12	n e	12	n	8	38	17	.....	.....	.....	.....
00	.....	60	Clr.Cu.	100	St.	n	4	s w	12	s w	8	39	23	.....	.....	.....	.....
00	.....	00	.....	00	.....	s w	4	w	7	....	0	54	26	.....	.....	.....	.....
----	.....	----	.....	----	.....	...	...	...	...	...	...	.....	.....	.....	.....	1.86	.....
62	.....	60	.....	58	.....	....	....	....	....	....	....	.....	.....	.....	.....	.....	.....
				60													

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Meteorological Observations for the Month of

Day of Month.	Thermometer in Open Air.				Relative Humidity or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	26	55	39	40	100	38	64	.141	.157	.152	29.354	29.326	29.270	29.317
2	38	64	43	48½	81	48	83	.178	.285	.231	29.164	29.027	29.077	29.089
3	40	56	49	48½	91	68	71	.225	.282	.247	29.125	28.943	28.912	28.993
4	39	47	35	40½	73	41	70	.173	.133	.142	28.958	29.120	29 278	29.119
5	24	48	34	35½	100	48	90	.139	.273	.175	29.349	29.260	29.235	29.280
6	39	63	51	51	55	28	34	.131	.205	.126	29.158	29.063	29.078	29 099
7	45	65	50	53½	46	40	72	.138	.244	.258	29.038	29.025	29.067	29.043
8	32	46	39	39	69	47	91	.125	.146	.216	29.334	29.312	29.345	29.327
9	28	43	41	37½	88	92	100	.135	.254	.257	29.234	29.008	28.958	29.067
10	36	40	36	37½	80	82	80	.170	.073	.170	29.005	28.967	28.992	28.988
11	34	47	31	37½	52	28	69	.108	.090	.118	29.018	29.073	29.205	29.100
12	25	46	27	32½	62	54	88	.082	.169	.129	29.278	29.273	29.353	29.301
13	28	48	43	39½	88	43	100	.135	.143	.278	29.192	28.978	28.918	29.029
14	38	50	40	42½	72	53	91	.165	.186	.225	28.828	28.772	28.780	28.793
15	38	40	38	38½	91	82	81	.208	.208	.186	28.865	28.925	29.022	28.987
16	34	46	42	40½	100	62	66	.196	.192	.177	28.902	28.663	28.695	28.753
17	32	41	33	35½	69	41	69	.125	.105	.113	28.937	28.975	29.010	28.974
18	29	46	38	37½	78	26	38	.123	.082	.091	28.983	28.698	28.756	28.879
19	33	36	20	29½	89	90	100	.168	.191	.108	28.422	28.333	28.432	28.395
20	24	26	24	24½	100	100	100	.129	.141	.129	28.575	28.725	28.917	28.739
21	16	25	20	20½	100	100	100	.090	.135	.108	28.874	28.808	28.928	28.870
22	23	33	34	30	100	100	90	.123	.188	.175	28 973	28.988	29.082	28.997
23	30	35	31	32	78	100	89	.130	.142	.155	29.211	29.276	29.355	29.281
24	30	32	32	31½	100	100	100	.167	.181	.181	29.268	29.174	29.070	29.171
25	33	34	33	33½	100	100	100	.188	.196	.188	29.208	29.185	29.092	29.162
26	35	43	54	44	100	100	100	.206	.196	.418	29.138	29.067	28.960	29.055
27	36	28	21	28½	100	100	100	.212	.153	.113	28.967	29.138	29.261	29.122
28	15	18	13	15½	100	100	100	.136	.098	.078	29.459	29.516	29.588	29.521
29	16	26	24	22	100	100	100	.090	.141	.129	29.637	29.623	29.650	29.637
30	20	31	20	23½	100	100	100	.108	.174	.108	29.791	29.851	29.868	29.835
31														
Sums														
Means				35°.66	85	70	85	.146	.174	.172				29.096
Average						80			.161					

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November, 1887, at Agricultural College, Michigan.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning Rain or Snow.	Ending Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
100	Fog.	00	.....	00	.....	....	....	s	12	s	1	55	26	.....	.....	.....	.....
10	St.	00	.....	10	St.	s w	8	s w	8	....	0	64	37	.....	.....	.....	.....
100	St.	Sm	oky.	40	St.	e	12	s	12	s w	3	59	39	.....	.....	.....	.....
30	St.	40	Cu.	90	St.	s w	1	w	12	w	8	49	23	.....	.....	.....	.....
30	Clr.	00	.....	00	.....	w	12	s w	16	w	16	48	23	.....	.....	.....	.....
00	.....	Sm	oky.		Hazy.	s w	16	s w	24	s w	12	63	42	.....	.....	.....	.....
Sm	oky.	Sm	oky.	00	.....	s w	6	s w	8	w	5	65	30	.....	.....	.....	.....
100	St.	00	.....	00	.....	n e	4	e	18	n e	8	46	25	.....	.....	.....	.....
60	St.	100	Nim.	100	Nim.	e	5	s e	3	s e	6	44	28	12 m.	10 p. m.	.20	.....
100	Cu. St.	80	Cu. St.	100	Cu. St.	n w	5	w	12	w	16	40	34	.....	.....	.....	.....
100	Cu. St.	00	.....	00	.....	n w	16	n w	16	w	4	47	25	.....	.....	.....	.....
00	.....	10	Clr.	00	.....	....	0	n	8	....	0	47	22	.....	.....	.....	.....
50	St.	80	Clr.Cu.	100	St.	s	1	s	8	s	5	48	28	.....	.....	.....	.....
100	St.	100	Cu. St.	100	Cu. St.	s e	5	s e	4	s w	3	54	35	.....	.....	.....	.....
90	Cu. St.	90	Cu. St.	90	Cu. St.	w	6	w	12	....	....	42	34	.....	.....	.....	.....
50	St.	00	.....	00	.....	s e	12	s	8	s w	16	48	31	.....	.....	.....	.....
100	Cu. St.	10	Cu.	50	Cu.	w	20	w	24	w	6	42	26	.....	.....	.....	.....
00	.....	00	.....	00	.....	s w	12	s w	24	s w	20	42	31	.....	.....	.....	.....
100	Fog.	100	Hazy.	100	Hazy.	s w	12	s	12	s w	8	37	19	3 a. m.	.....	.13	.....
100	Hazy.	100	Hazy.	100	Hazy.	s w	12	s w	16	s w	8	26	16	.....	9 p. m.	.....	2½
100	Cu.	90	Cu.	00	.....	s	8	s	20	s	3	26	16	.....	.....	.....	.....
Sm	oky.	Sm	oky.	Sm	oky.	s	8	s	3	s	1	34	22	.....	.....	.....	.....
Sm	oky	Sm	oky.	Sm	oky.	n	3	n	7	n e	8	36	23	.....	.....	.....	.....
100	St.	100	St.	100	St.	n e	8	n e	8	n e	1	34	30	9 a. m.	5 p. m.	.18	.....
	Hazy.		Hazy.		Hazy.	n w	1	n w	3	n e	1	34	30	2 p. m.	9 p. m.	.37	.....
	Hazy.		Hazy.		Hazy.	....	....	e	3	s	12	60	30	a. m.	8 p. m.	.72	.....
90	Nim.	90	Nim.	100	Nim.	w	12	w	16	w	16	38	15	.....	12 m.	.68	.....
100	Cu.	50	Cu.	00	.....	w	12	w	8	s w	6	19	13	.....	.....	.....	.....
90	Cu.	80	Cu.	100	Cu.	s w	6	s w	8	s w	1	26	16	.....	.....	.....	.....
100	Cu.	10	Cu. St.	00	.....	n e	5	n e	5	n e	2	31	19	.....	.....	.....	.....
..	.....	..	.....	..	.....	....	....	....	....	....	....	.....	.....	.....	.....	.....	.....
....	.....	....	.....	....	.....	....	....	....	....	....	....	.....	.....	.....	.....	2.23	2½
72	.....	47	.....	47	.....	....	....	....	....	....	....	.....	.....	.....	.....	.....	.....

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Meteorological Observations for the Month of

Day of Month.	Thermometer in Open Air.				Relative Humidity or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	20	35	27	27½	100	100	64	.108	.204	.093	29.778	29.593	29.412	29.594
2	29	35	35	33	89	100	90	.142	.188	.175	29.220	29.228	29.191	29.213
3	35	36	43	38	100	90	92	.188	.191	.254	29.309	29.196	29.005	29.170
4	50	39	36	41⅞	93	81	79	.335	.166	.155	28.821	28.995	28.948	28.921
5	29	35	28	30⅝	78	90	88	.123	.175	.135	29.306	29.403	29 254	29.321
6	26	43	35	34¼	100	42	61	.141	.113	.120	29.483	29.280	29.193	29.319
7	34	39	35	36	79	73	71	.155	.173	.149	29.141	29.082	29.180	29.134
8	33	36	31	33⅓	89	70	89	.168	.142	.153	29.275	29.380	29.233	29.296
9	31	42	38	37	69	82	90	.125	.212	.199	29 275	29.185	29.135	29.198
10	37	37	37	37	81	90	90	.186	.199	.191	28.985	28.980	28.927	28.964
11	32	30	26	29½	.....	100	88	.077	.160	.123	29.003	28.982	28.995	28.993
12	28	27	25	26⅝	88	88	87	.129	.123	.117	29.148	29.196	29.212	29.185
13	30	33	26	29⅝	100	89	87	.160	.168	.117	29.206	29.108	29.087	29.167
14	31	33	31	31⅝	89	89	100	.155	.168	.174	29.283	29.297	29.091.	29.224
15	29	28	24	27	100	100	100	.160	.147	.129	29.280	29.241	29.183	29.235
16	25	29	26	26⅝	100	100	88	.135	.153	.191	29 175	29.080	28.985	29.080
17	25	28	28	27	88	100	100	.123	.147	.153	28.900	28.692	28.587	28.726
18	30	34	33	32½	89	79	79	.155	.155	.150	28.900	28.892	28.998	28.930
19	33	38	36	35½	89	72	80	.162	.165	.170	29.095	28.992	28.992	29.026
20	33	39	32	34⅝	100	64	100	.181	.152	.181	29.082	28.872	28.874	28.943
21	18	12	9	13	100	80	100	.098	.080	.065	29.178	29.198	29.079	29.152
22	14	15	14	14½	100	82	82	.082	.070	.067	29.113	29.100	29.066	29.093
23	13	21	24	19½	81	85	87	.063	.091	.111	28.918	28.821	28.813	28.851
24	14	20	19	17⅝	82	100	85	.067	.103	.057	28.898	28.908	28.792	28.866
25	19	22	19	20	85	86	85	.087	.101	.087	28.934	28.898	28.892	28.908
26	18	22	18	19½	100	100	100	.094	.113	.094	29.000	28.905	28.913	28.939
27	24	31	31	28⅝	100	69	100	.123	.118	.174	29.036	28.845	28.565	28.815
28	20	13	13	15½	85	100	62	.091	.078	.048	28.759	28.985	29.192	28.979
29	10	19	9	12⅝	100	39	78	.068	.039	.051	29.452	29 514	29.624	29.530
30	-2	16	16	10	100	66	66	.040	.059	.059	29.618	29.469	29.314	29.367
31	20	26	35	27	85	100	70	.091	.141	.142	28.943	28.758	28.640	28.780
Sums	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Means	.....	.....	.....	27 °30	91	84	85	.129	.133	.131	.....	.....	.....	29.096
Average						87			.131					

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December, 1887, at Agricultural College, Michigan.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow. Inches.
10	Cu. St.	100	Cu. St.	00	.....	e	5	s	12	se	16	35	20	.....	.....	.....	.....
100	Nim.	100	Nim.	70	Cir.Cu.	s	12	s	12	s	8	33	28	3 a. m.	.....	.....	.....
100	Nim.	100	Nim.	100	Nim.	se	2	e	8	s	12	50	30	.....	.....	.....	.....
100	Nim.	100	Nim.	00	.....	se	16	s w	16	s w	20	54	24	.....	6 a. m.	1.15	.....
30	Cir.Cu.	40	Cir.Cu.	100	Cu. St.	w	8	s w	12	s w	8	35	24	.....	.....	.....	.....
100	Cu. St.	00	.....	50	Cir.Cu.	s	6	s	5	s	4	43	25	.....	.....	.....	.....
100	Nim.	100	Nim.	80	Cu. St.	s	3	s	6	s	2	42	25	.....	.....	.....	.....
100	Nim.	100	Cu. St.	00	.....	n	3	se	1	e	3	56	24	.....	.....	.....	.....
Sm	oky.	40	Cu.	50	St.	se	4	se	2	se	1	43	28	.....	.....	.....	.....
100	Nim.	100	Nim.	100	Nim.	n e	1	n e	5	n e	6	40	32	8 a. m.	.....	.....	.....
100	Nim.	100	Nim.	100	Nim.	n e	3	n	4	s w	8	39	24	.....	10 p. m.	.75	.....
100	Nim.	100	Nim.	100	Nim.	w	8	s w	8	s w	8	38	24	.....	.....	.....	.....
100	Nim.	50	Cu.	00	.....	s w	9	s w	7	s w	6	42	25	.....	.....	.....	.....
100	Cu. St.	100	Cu. St.	100	Cu. St.	s w	3	s	2	s w	1	35	26	9 a. m.	3 p. m.	.20	2
100	St.	50	Cu. St.	00	.....	n w	6	n w	8	n w	4	34	22	.....	.....	.....	.....
50	Cu. St.	50	Cu. St.	50	Cu. St.	w	5	s w	12	w	8	35	24	.....	.....	.....	.....
50	Cu. St.	50	Cu. St.	50	Cu. St.	s	6	s w	5	s	5	32	25	.....	.....	.....	.....
50	Cu. St.	50	Cu. St.	50	Cu. St.	w	6	n w	6	w	1	36	29	.....	.....	.....	.....
50	Cu. St.	100	St	00	.....	s	8	se	8	se	8	38	31	.....	.....	.....	.....
50	Cu. St.	50	Cu. St.	100	Nim.	se	4	e	6	w	5	40	18	2 p. m.	.....	.....	.....
100	Nim.	100	Nim.	100	Nim.	w	12	w	12	s w	12	40	5	.....	.....	.....	.....
100	Nim.	100	Nim.	100	Nim.	s w	16	s w	16	s w	12	39	10	.....	6 p. m.	.40	4
50	Cu. St.	50	Cu. St.	100	St.	s	3	s	7	s	6	41	12	.....	.....	.....	.....
100	Nim.	100	Nim.	100	St.	s w	7	s w	10	w	4	38	13	.....	.....	.....	.....
100	Nim.	100	Nim.	100	St.	se	8	s w	12	s	6	38	15	.....	.....	.....	.....
50	Cu. St.	50	Cu. St.	100	St.	s	6	s	13	s	5	34	11	.....	.....	.....	.....
50	Nim.	100	Cu. St.	100	Nim.	s	8	se	15	s	8	34	20	3 p. m.	.....	.....	.....
100	Nim.	100	Nim.	30	Cu. St.	w	15	w	12	w	8	20	10	.....	3 p. m.	.32	4
10	St.	40	Cu. St.	80	Cir. St.	n w	8	n w	12	w	12	20	-3	.....	.....	.....	.....
10	St.	100	Cu. St.	100	St.	w	12	s	12	se	8	20	-2	10 p. m.	.....	.....	.....
100	Nim.	100	Nim.	100	Nim.	e	2	se	6	s	5	37	20	.....	12 m.	.50	8
----	.....	----	---- ---	----	.....	----	----	----	----	----	----	•	----	----	.....	3.32	13
76	.....	78	.....	68	.....	----	----	----	----	----	----	.....	.....	.....	.....	.....	.....
		74															

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